

KNIFE RIVER

ENVIRONMENTAL TROUBLE SHOOTERS LAKE COUNTY, MINNESOTA AUGUST 2019



MADISON
6140 COTTONWOOD DRIVE, SUITE A
FITCHBURG, WISCONSIN 53719
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COVER SHEET
KNIFE RIVER
ENVIRONMENTAL TROUBLE SHOOTERS
LAKE COUNTY, MINNESOTA

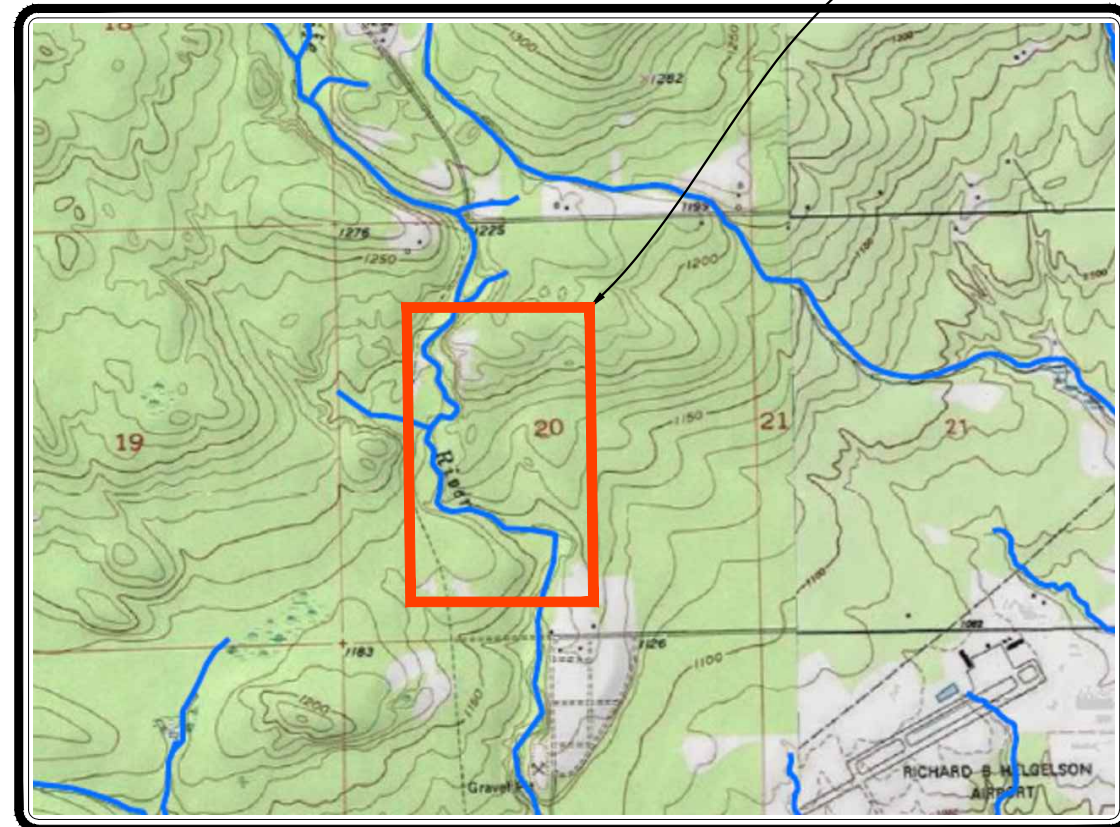
#	DATE	DESCRIPTION

DATE	JANUARY 2020
DRAWN	COD
DESIGNED	ACS
CHECKED	
PROJECT #	J188372100
SHEET TITLE	COVER
SHEET NUMBER	1
LAND USE #	

Sheet List Table

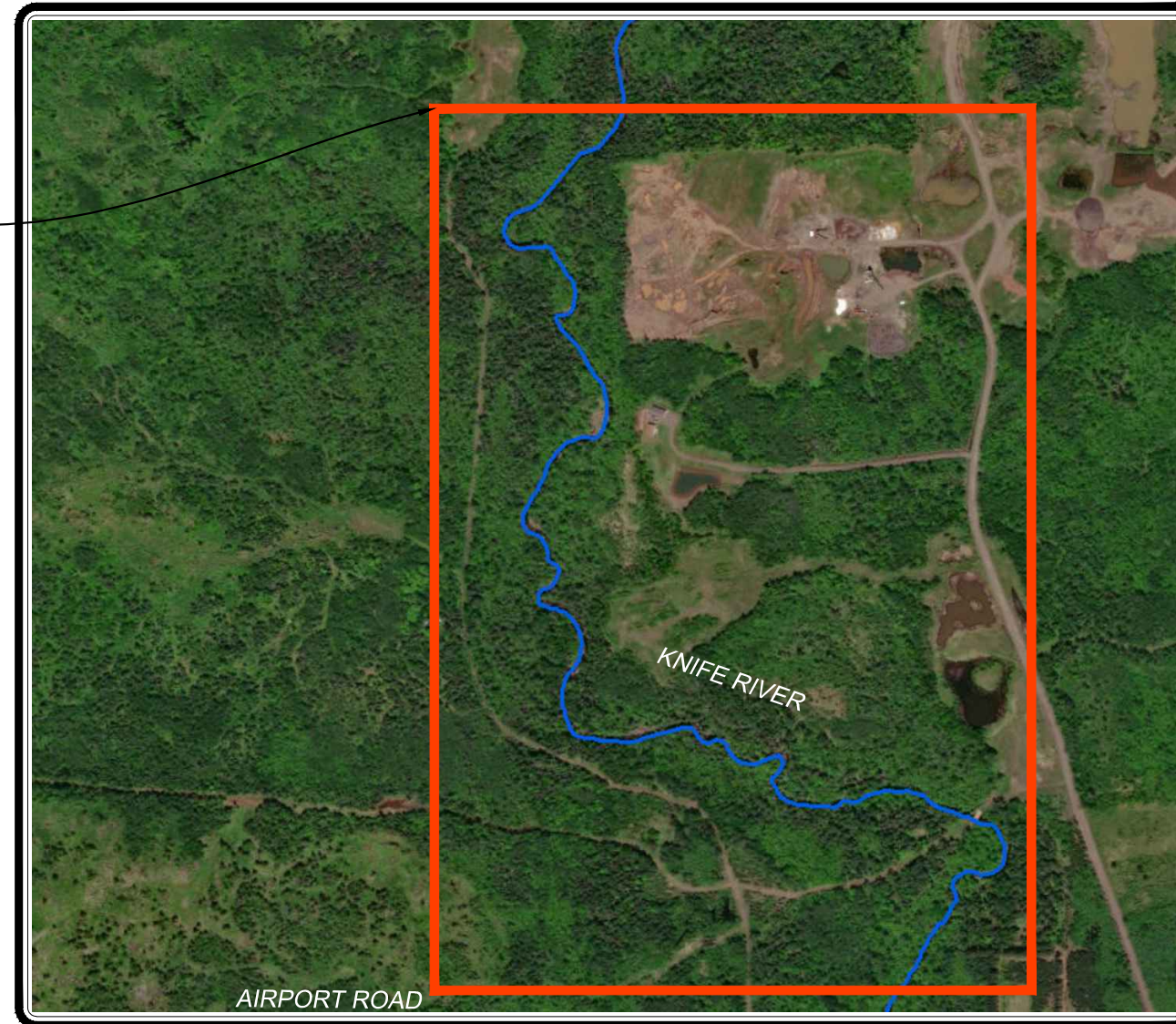
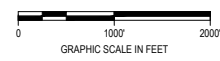
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These restoration design plans and specifications were prepared for the Lake Superior Steelhead Associations Reach 4 Knife River Restoration project using Federal funds under award NA18NOS4190081 from the Coastal Zone Management Act of 1972, as amended, administered by the Office for Coastal Management, National Oceanic and Atmospheric Administration (NOAA), U.S. Department of Commerce provided to the Minnesota Department of Natural Resources (MNDNR) for Minnesota's Lake Superior Coastal Program. The statements, findings, conclusions, and recommendations are those of the author(s) and do not necessarily reflect the views of NOAA, the U.S. Department of Commerce, or the MNDNR.



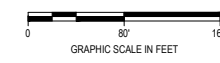
GRAPHIC SCALE VERIFICATION
This bar measures 1" on 22"x34"
or 1/2" on 11"x17" original.
Adjust scale accordingly.

VICINITY MAP
SCALE: 1" = 1000'



GRAPHIC SCALE VERIFICATION
This bar measures 1" on 22"x34"
or 1/2" on 11"x17" original.
Adjust scale accordingly.

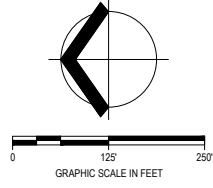
SITE MAP
SCALE: 1" = 80'



60% DESIGN

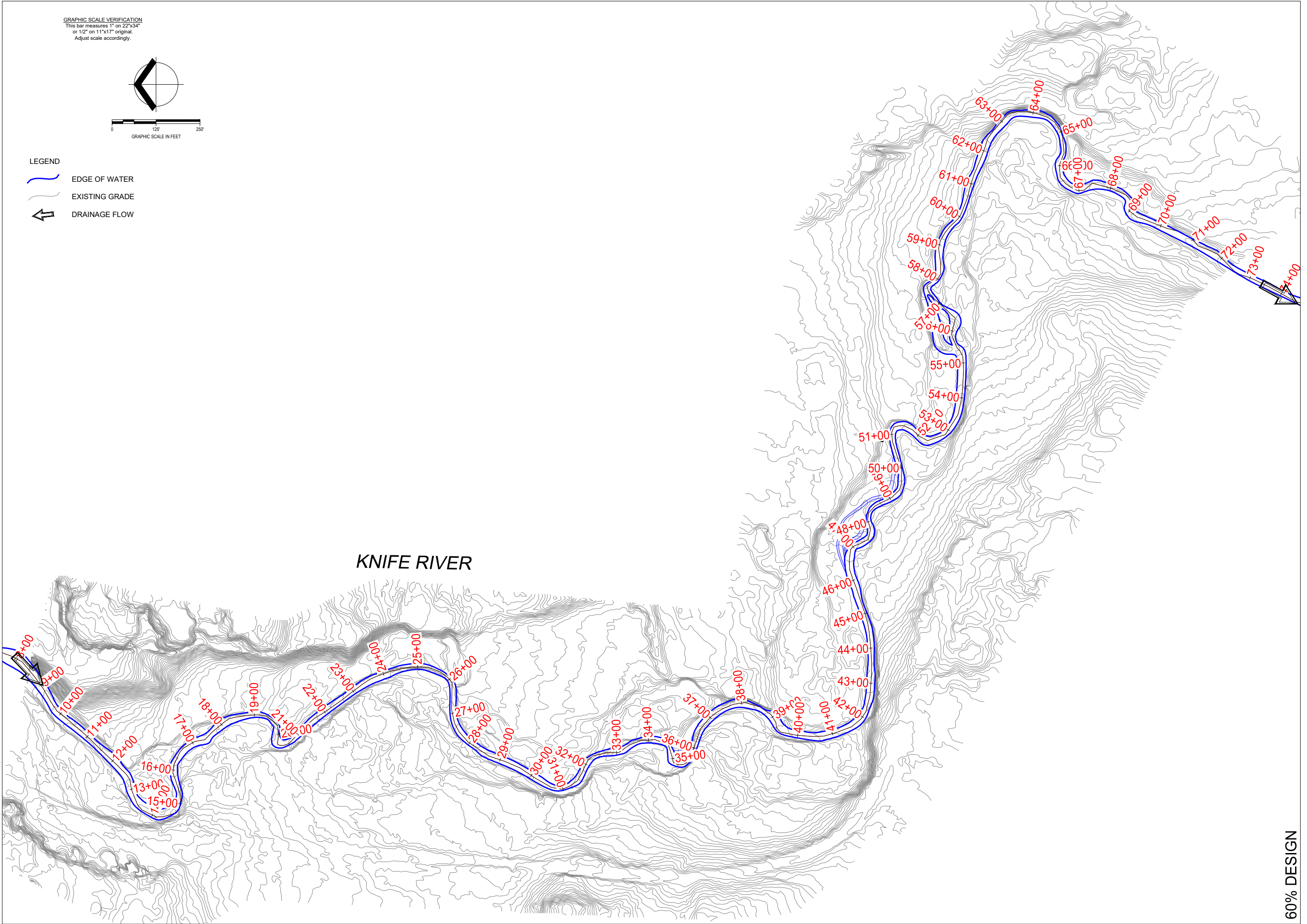
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GRAPHIC SCALE VERIFICATION
This bar measures 1" on 22"x34"
or 1/2" on 11"x17" original.
Adjust scale accordingly.



LEGEND

- EDGE OF WATER
- EXISTING GRADE
- DRAINAGE FLOW



KNIFE RIVER

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EXISTING CONDITIONS
KNIFE RIVER
ENVIRONMENTAL TROUBLE SHOOTERS
LAKE COUNTY, MINNESOTA

#	DATE	DESCRIPTION

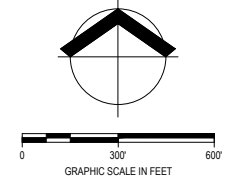
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DRAWN	MGSCOD
DESIGNED	IACS
CHECKED	I
PROJECT #	J188372100

SHEET TITLE	
EXISTING	
SHEET NUMBER	
3	
LAND USE #	

60% DESIGN



GRAPHIC SCALE VERIFICATION
This bar measures 1" on 22"x34"
or 1/2" on 11"x17" original.
Adjust scale accordingly.



LEGEND

- EDGE OF WATER
- ACCESS PATH
- STOCKPILE LOCATION

CONSTRUCTION ACCESS
KNIFE RIVER
ENVIRONMENTAL TROUBLE SHOOTERS
LAKE COUNTY, MINNESOTA

#	DATE	DESCRIPTION

DATE | JANUARY 2020
DRAWN | MGSCOD
DESIGNED | ACS
CHECKED | I
PROJECT # | J188372100

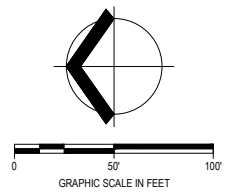
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ACCESS

SHEET NUMBER
4

60% DESIGN

LAND USE # —

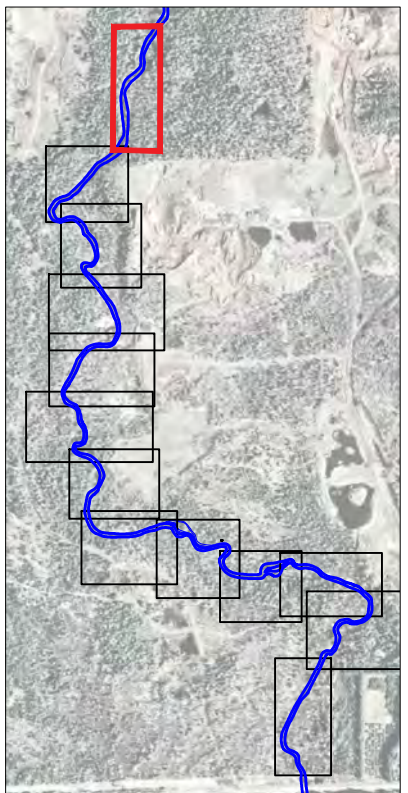
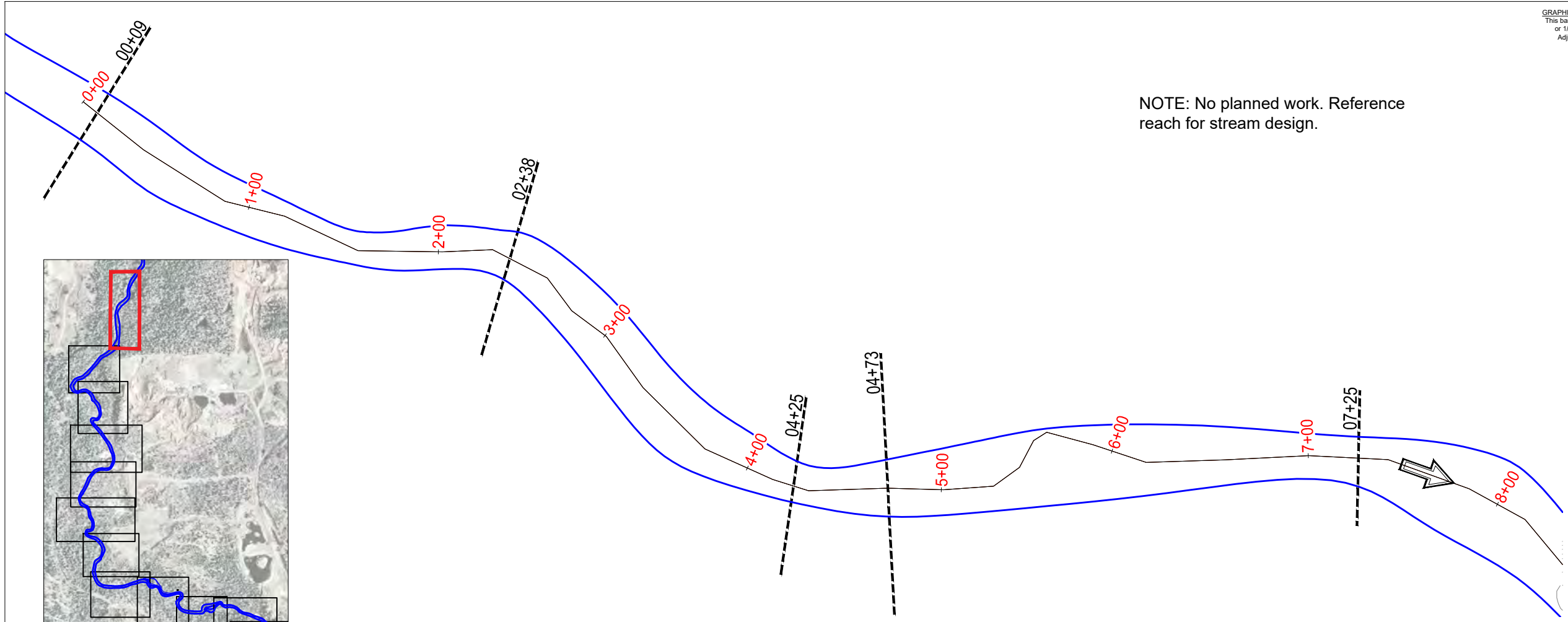
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 Adjust scale accordingly.



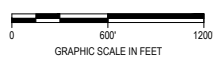
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LEGEND

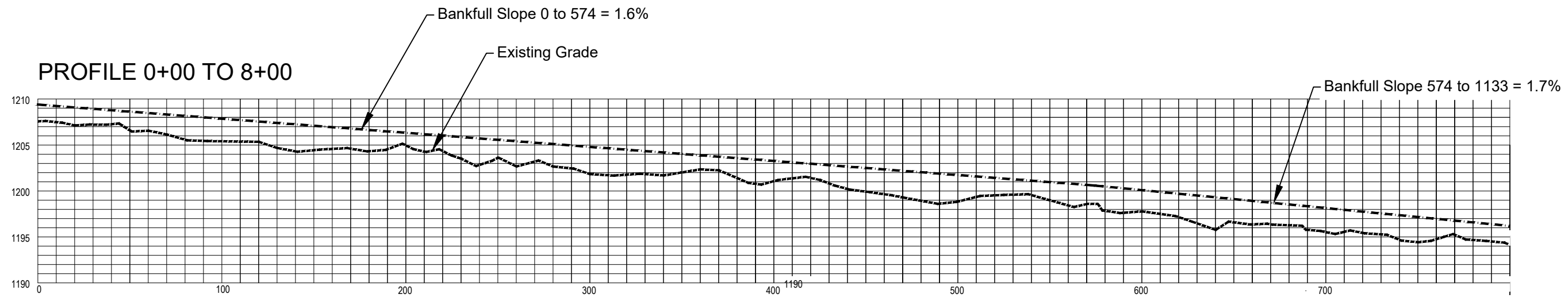
- EDGE OF WATER
- EXISTING GRADE
- DRAINAGE FLOW



KEY MAP
 GRAPHIC SCALE VERIFICATION
 This bar measures 1" on 22"x34"
 or 1/2" on 11"x17" original.
 Adjust scale accordingly.



PROFILE 0+00 TO 8+00



REFERENCE REACH 0+00 TO 0+95
 KNIFE RIVER
 ENVIRONMENTAL TROUBLE SHOOTERS
 LAKE COUNTY, MINNESOTA

#	DATE	DESCRIPTION

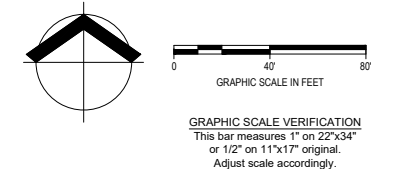
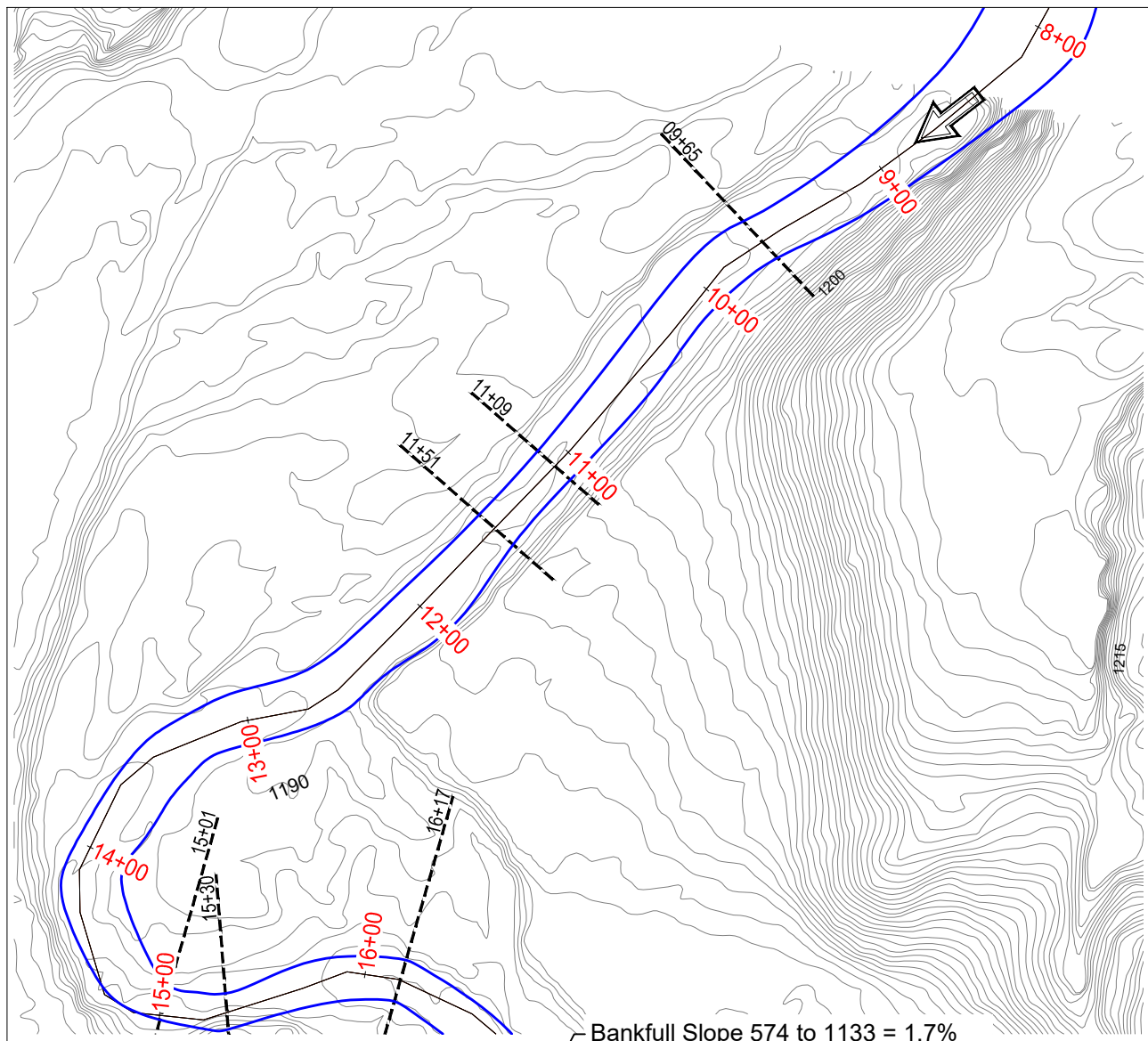
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DRAWN	JMGS/COD
DESIGNED	JACS
CHECKED	I
PROJECT #	J188372100

SHEET TITLE
 REF 0+00 TO 0+95
 SHEET NUMBER

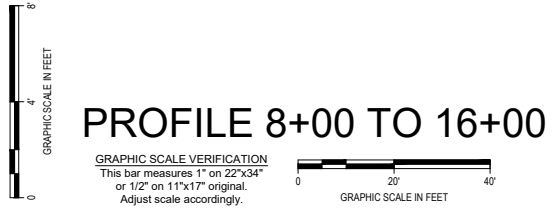
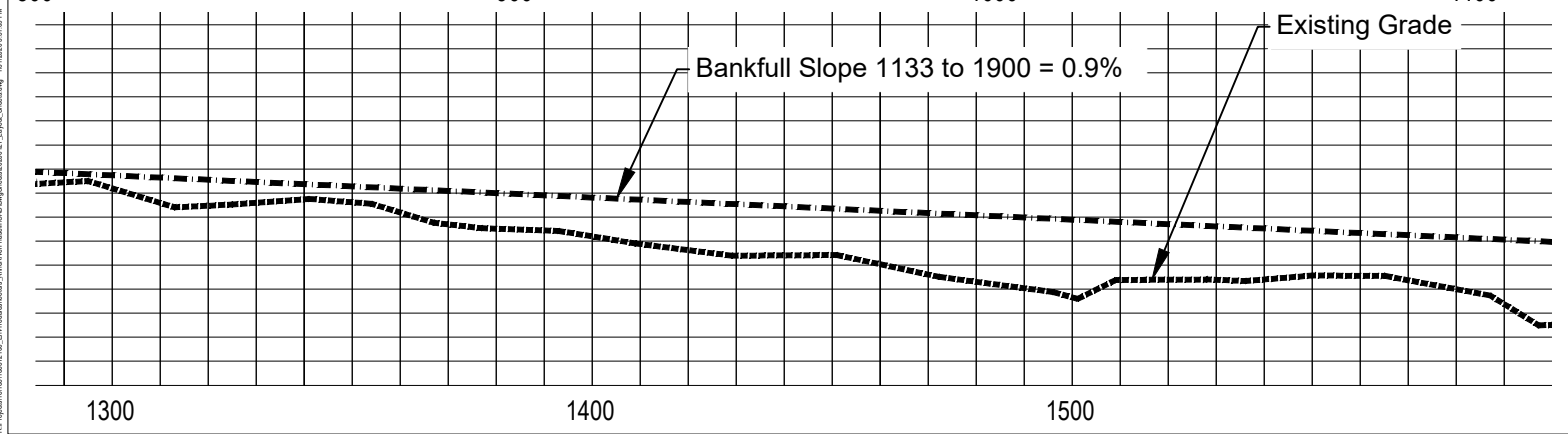
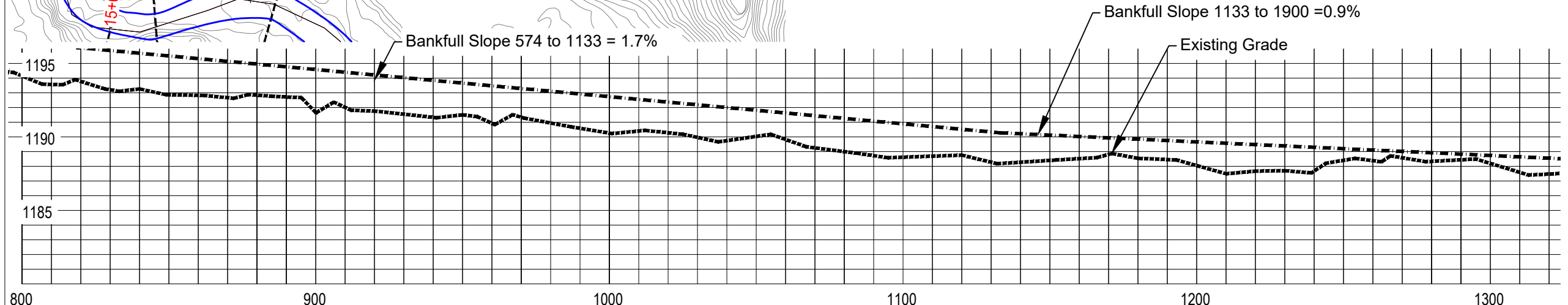
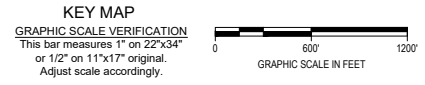
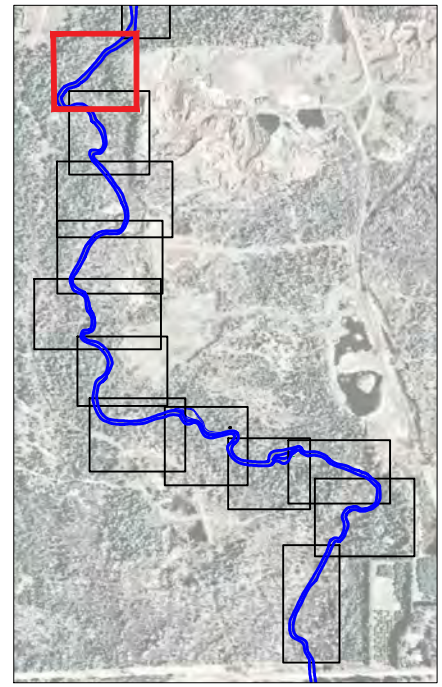
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60% DESIGN

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- LEGEND
- EDGE OF WATER
 - EXISTING GRADE
 - DRAINAGE FLOW

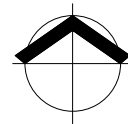
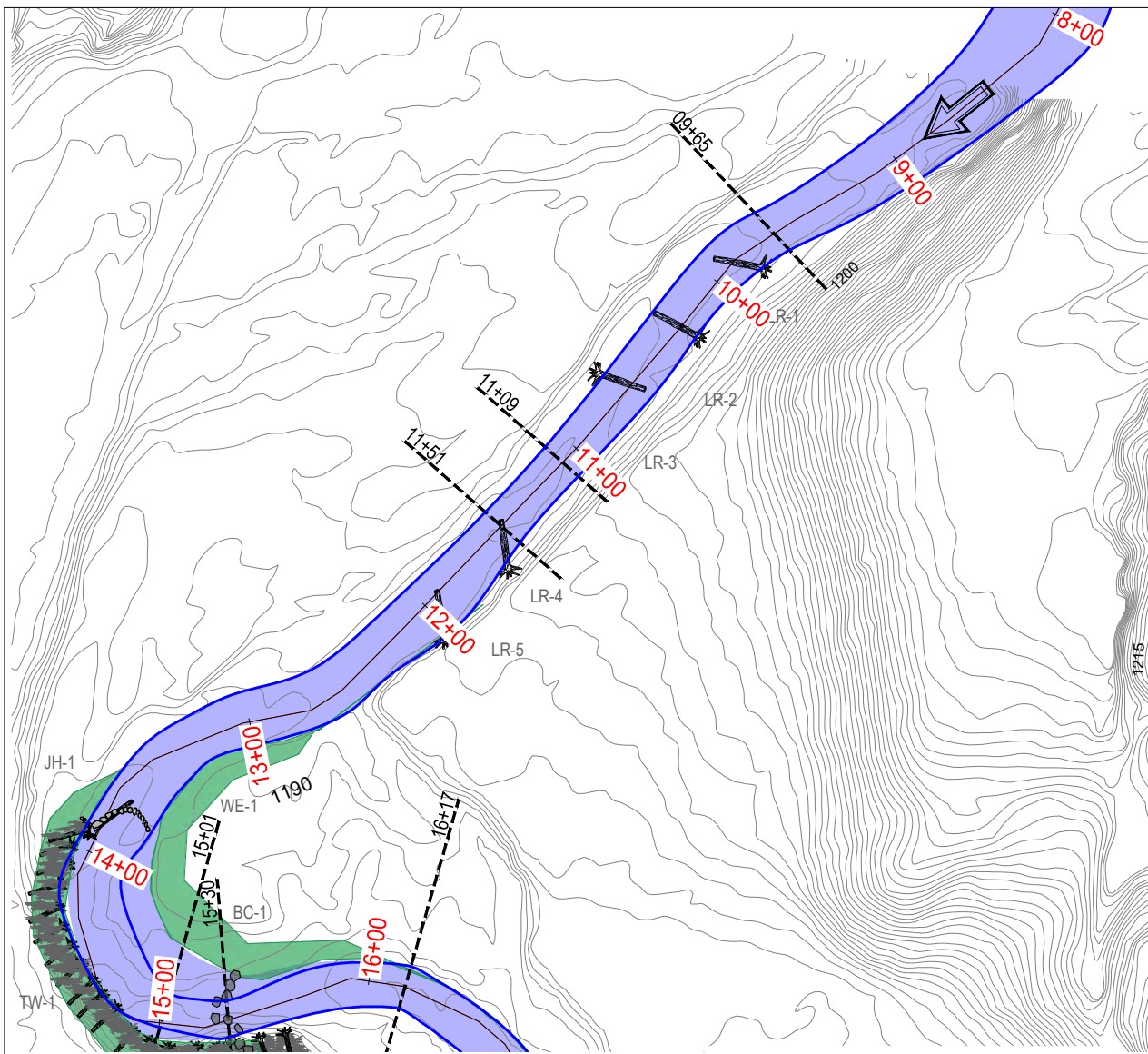


AREA 1 EXISTING CONDITIONS
KNIFE RIVER
ENVIRONMENTAL TROUBLE SHOOTERS
LAKE COUNTY, MINNESOTA

#	DATE	DESCRIPTION

60% DESIGN

DATE	JANUARY 2020
DRAWN	JMGS/COD
DESIGNED	JACS
CHECKED	I
PROJECT #	J188372100
SHEET TITLE	AREA 1
SHEET NUMBER	6
LAND USE #	

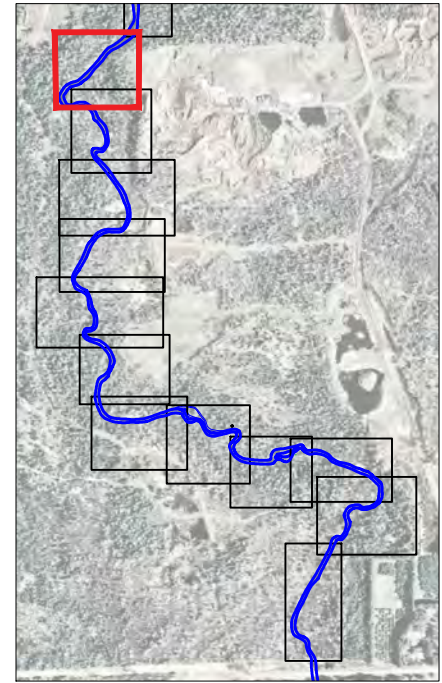


GRAPHIC SCALE IN FEET
 0 40 80
 GRAPHIC SCALE VERIFICATION
 This bar measures 1" on 22"x34"
 or 1/2" on 11"x17" original.
 Adjust scale accordingly.

- LEGEND
- EDGE OF WATER
 - EXISTING GRADE
 - DRAINAGE FLOW
 - TOEWOOD
 - J-HOOK
 - BOULDER CLUSTER
 - CROSS VANE
 - BANK GRADING
 - CHANNEL RE-ROUTE
 - SUBGRADE LOG VANE
 - LOG ROLLER
 - CHANNEL TO BE FILLED
 - CONSTRUCTED RIFFLE
 - LARGE WOOD HABITAT ENHANCEMENT

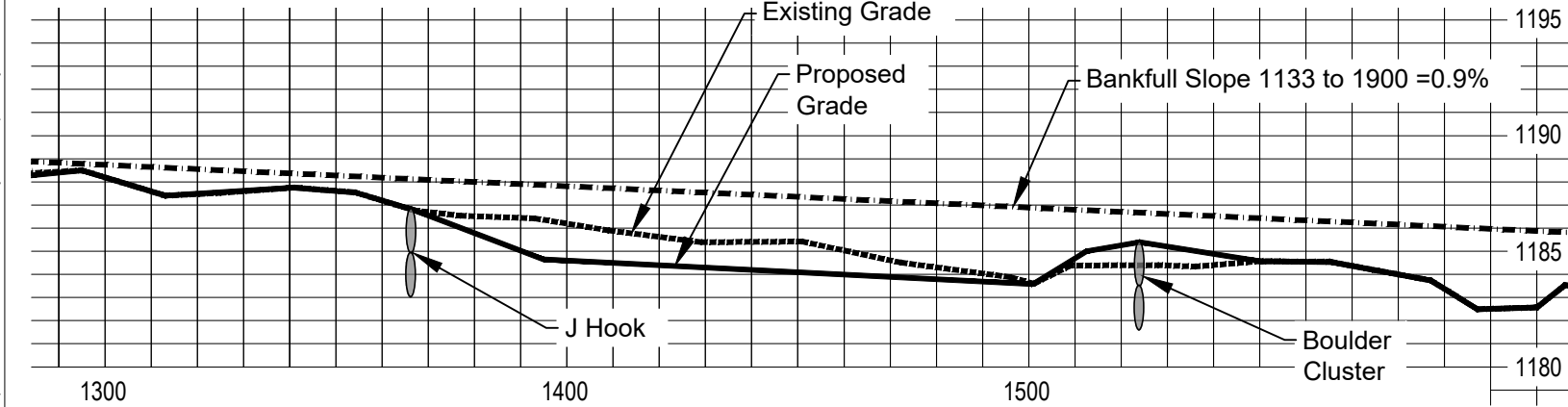
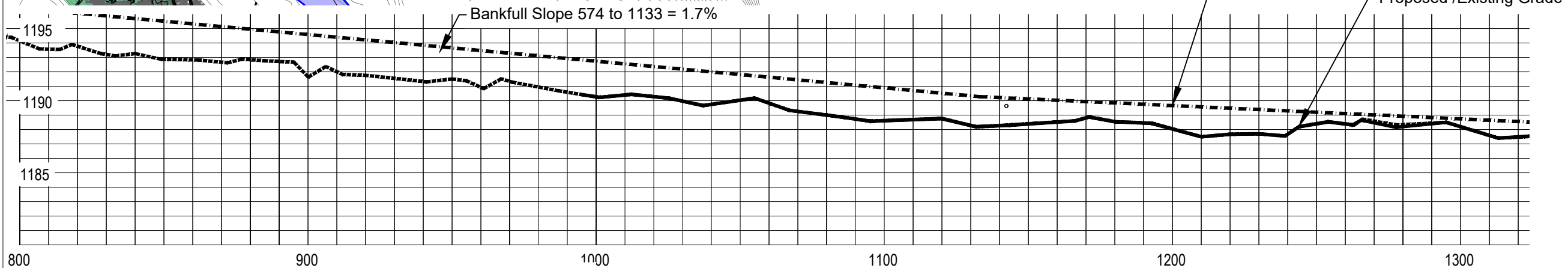
WORK CONSTRUCTED IN SUMMER
 2019 FROM STATION 9+00
 THROUGH STATION 21+00

NOTE:
 1. Final position, orientation, and elevation
 of large wood additions to be
 determined in the field by on-site
 construction supervisor.



KEY MAP
 GRAPHIC SCALE VERIFICATION
 This bar measures 1" on 22"x34"
 or 1/2" on 11"x17" original.
 Adjust scale accordingly.

0 600 1200
 GRAPHIC SCALE IN FEET



0 4 8
 GRAPHIC SCALE IN FEET

PROFILE 8+00 TO 16+00

GRAPHIC SCALE VERIFICATION
 This bar measures 1" on 22"x34"
 or 1/2" on 11"x17" original.
 Adjust scale accordingly.

0 20 40
 GRAPHIC SCALE IN FEET

AREA 1 PROPOSED PLAN
 KNIFE RIVER
 ENVIRONMENTAL TROUBLE SHOOTERS
 LAKE COUNTY, MINNESOTA

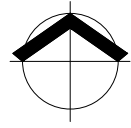
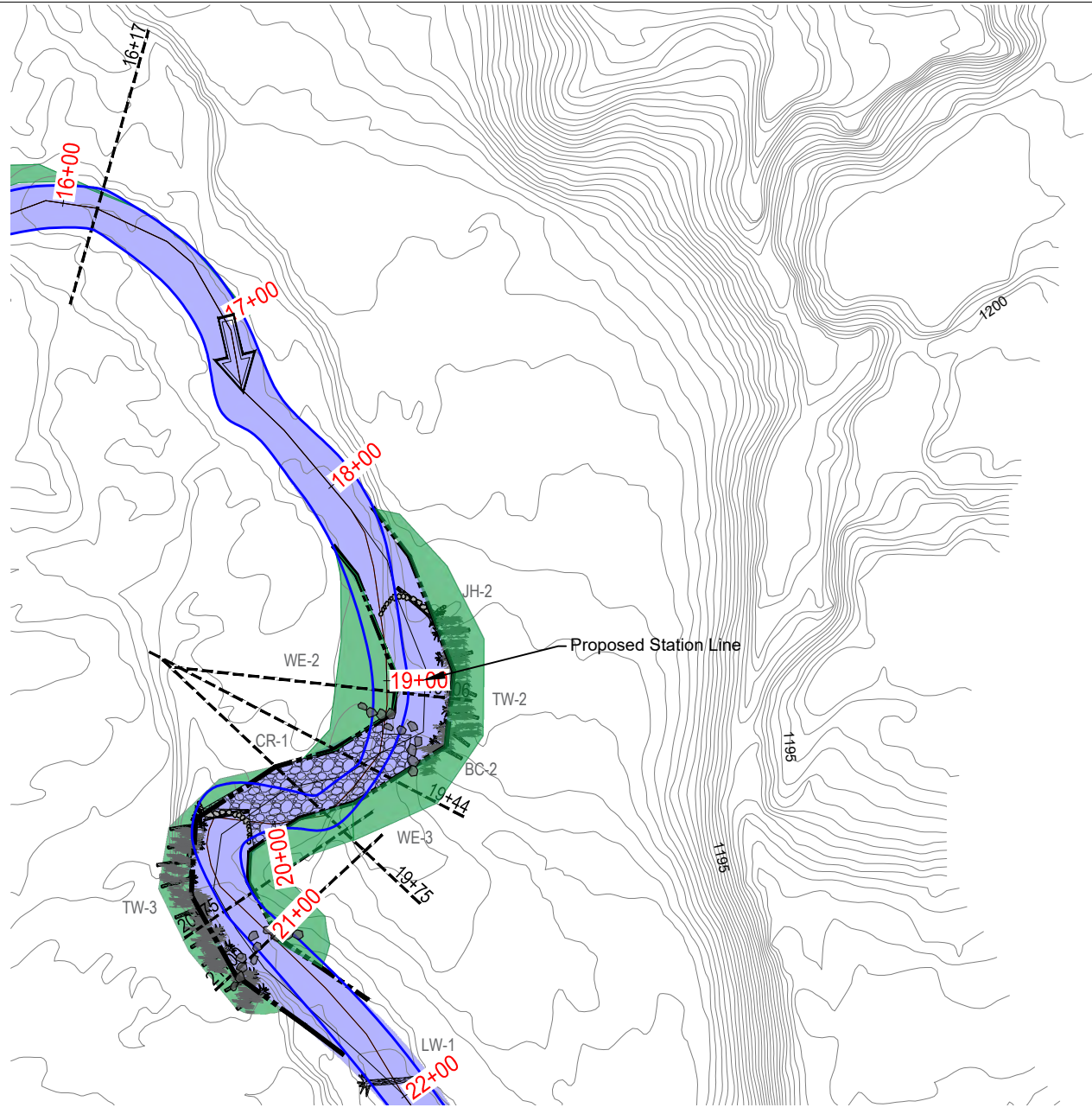
#	DATE	DESCRIPTION

DATE	JANUARY 2020
DRAWN	JMGS/COD
DESIGNED	JACS
CHECKED	I
PROJECT #	J188372100

SHEET TITLE	AREA 1
SHEET NUMBER	7
LAND USE #	

60% DESIGN

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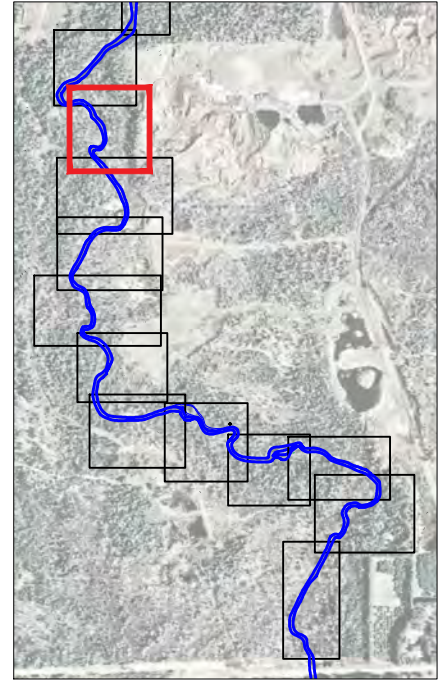


GRAPHIC SCALE IN FEET
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 GRAPHIC SCALE VERIFICATION
 This bar measures 1" on 22"x34"
 or 1/2" on 11"x17" original.
 Adjust scale accordingly.

- LEGEND**
- EDGE OF WATER
 - EXISTING GRADE
 - DRAINAGE FLOW
 - TOEWOOD
 - J-HOOK
 - BOULDER CLUSTER
 - CROSS VANE
 - BANK GRADING
 - CHANNEL RE-ROUTE
 - SUBGRADE LOG VANE
 - LOG ROLLER
 - CHANNEL TO BE FILLED
 - CONSTRUCTED RIFFLE
 - LARGE WOOD HABITAT ENHANCEMENT

WORK CONSTRUCTED IN SUMMER
 2019 FROM STATION 9+00
 THROUGH STATION 21+00

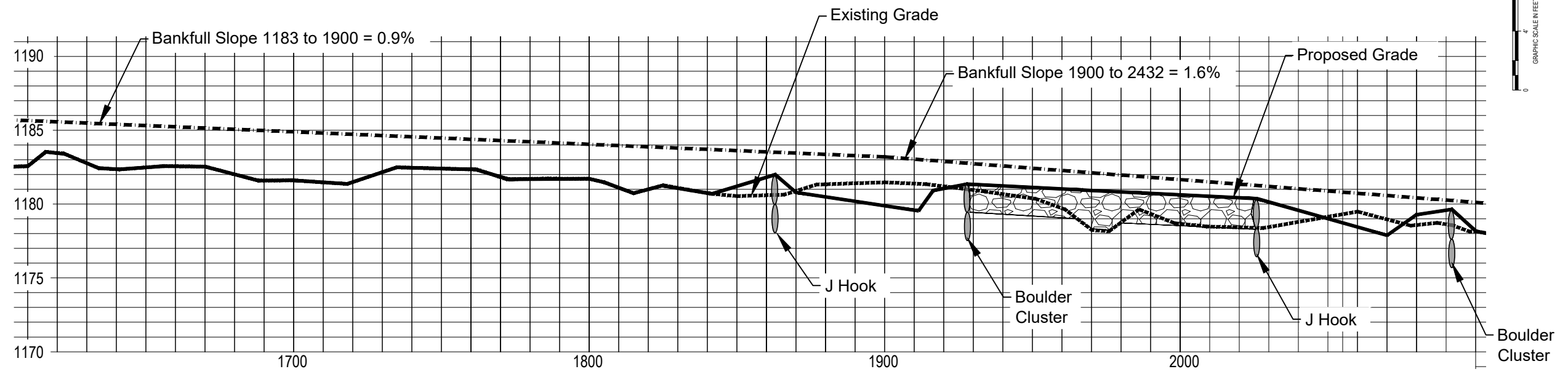
NOTE:
 1. Final position, orientation, and elevation
 of large wood additions to be
 determined in the field by on-site
 construction supervisor.



KEY MAP
 GRAPHIC SCALE VERIFICATION
 This bar measures 1" on 22"x34"
 or 1/2" on 11"x17" original.
 Adjust scale accordingly.

PROFILE 16+00 TO 21+00

GRAPHIC SCALE VERIFICATION
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 or 1/2" on 11"x17" original.
 Adjust scale accordingly.



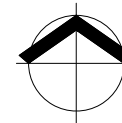
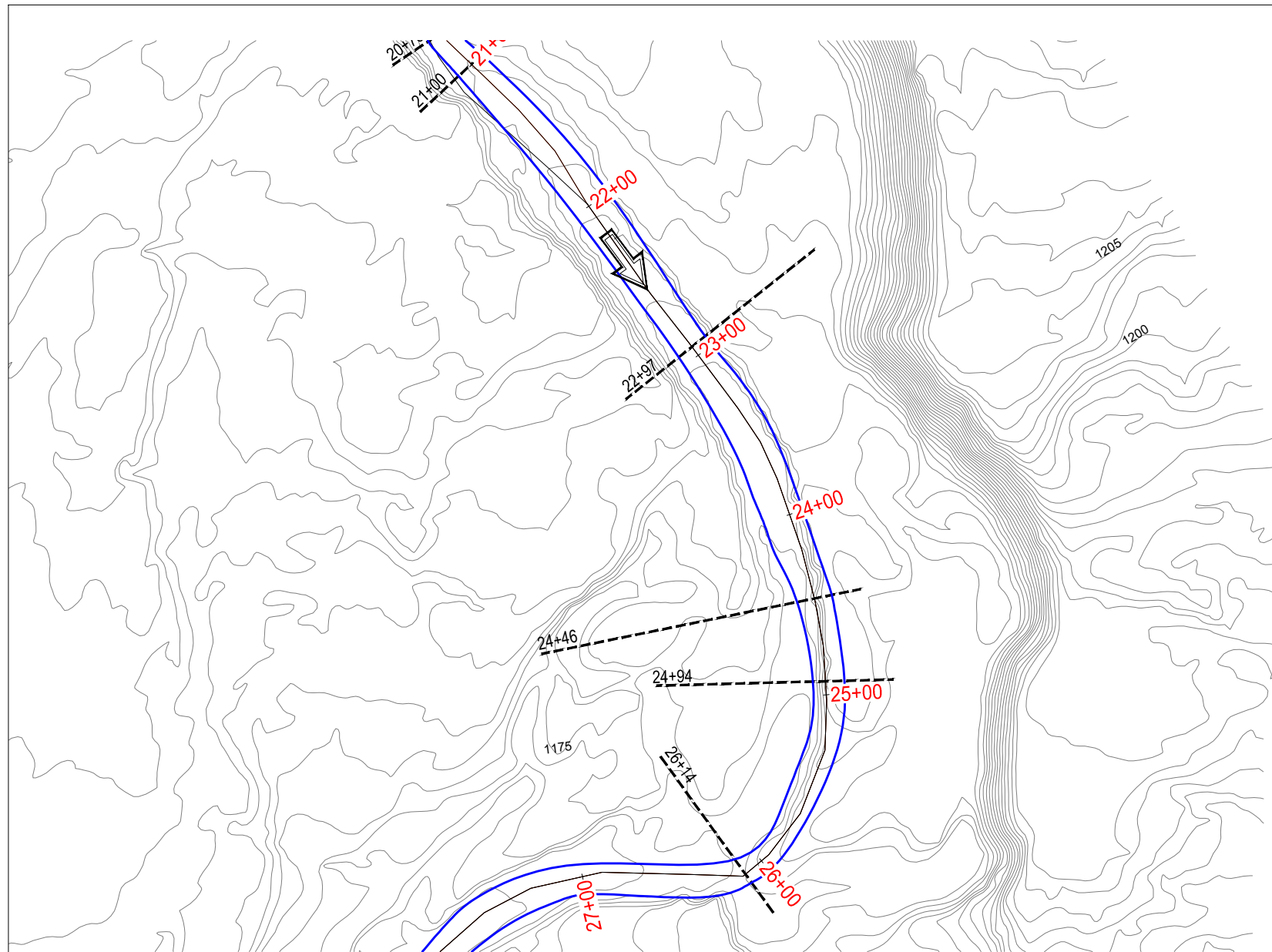
AREA 2 PROPOSED PLAN
KNIFE RIVER
ENVIRONMENTAL TROUBLE SHOOTERS
LAKE COUNTY, MINNESOTA

#	DATE	DESCRIPTION

DATE | JANUARY 2020
 DRAWN | MGS/COD
 DESIGNED | ACS
 CHECKED | I
 PROJECT # | J188372100
 SHEET TITLE | AREA 2
 SHEET NUMBER | **9**
 LAND USE # |

60% DESIGN

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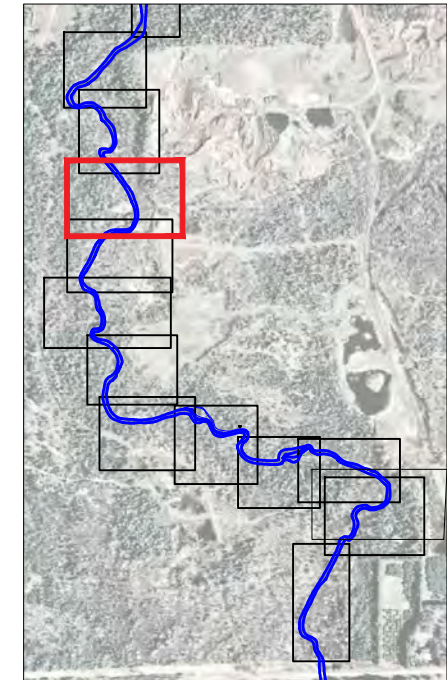


0 40 80
GRAPHIC SCALE IN FEET

GRAPHIC SCALE VERIFICATION
This bar measures 1" on 22"x34"
or 1/2" on 11"x17" original.
Adjust scale accordingly.

LEGEND

- EDGE OF WATER
- EXISTING GRADE
- DRAINAGE FLOW



KEY MAP
GRAPHIC SCALE VERIFICATION
This bar measures 1" on 22"x34"
or 1/2" on 11"x17" original.
Adjust scale accordingly.

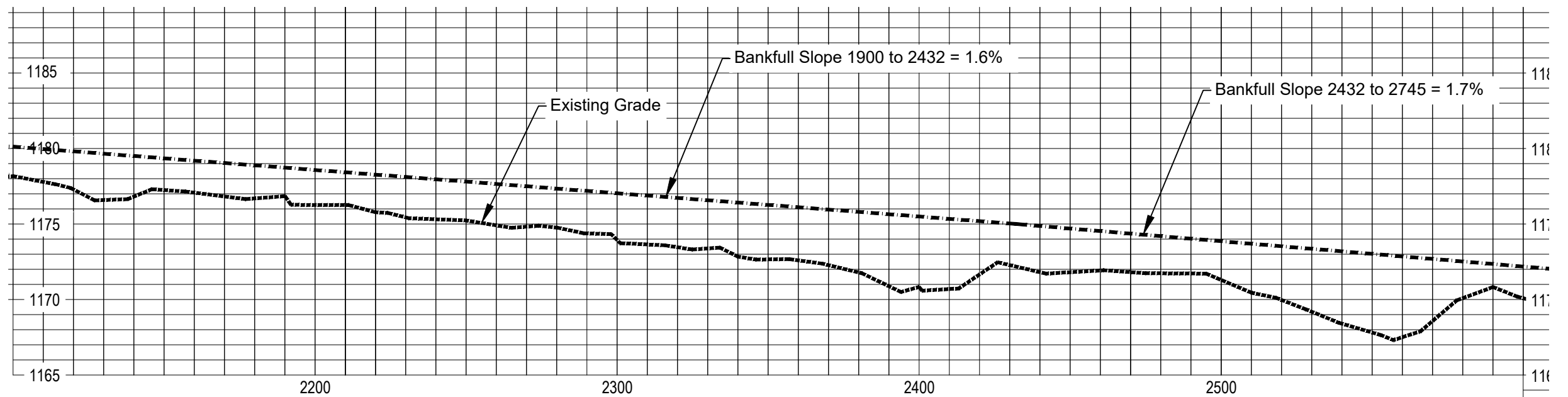
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PROFILE 21+00 TO 26+00

GRAPHIC SCALE VERIFICATION
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or 1/2" on 11"x17" original.
Adjust scale accordingly.

0 20 40
GRAPHIC SCALE IN FEET

0 2 4 6
GRAPHIC SCALE IN FEET



60% DESIGN

AREA 3 EXISTING CONDITIONS

KNIFE RIVER

ENVIRONMENTAL TROUBLE SHOOTERS

LAKE COUNTY, MINNESOTA



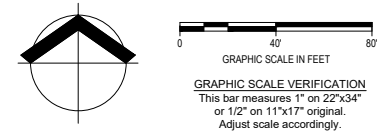
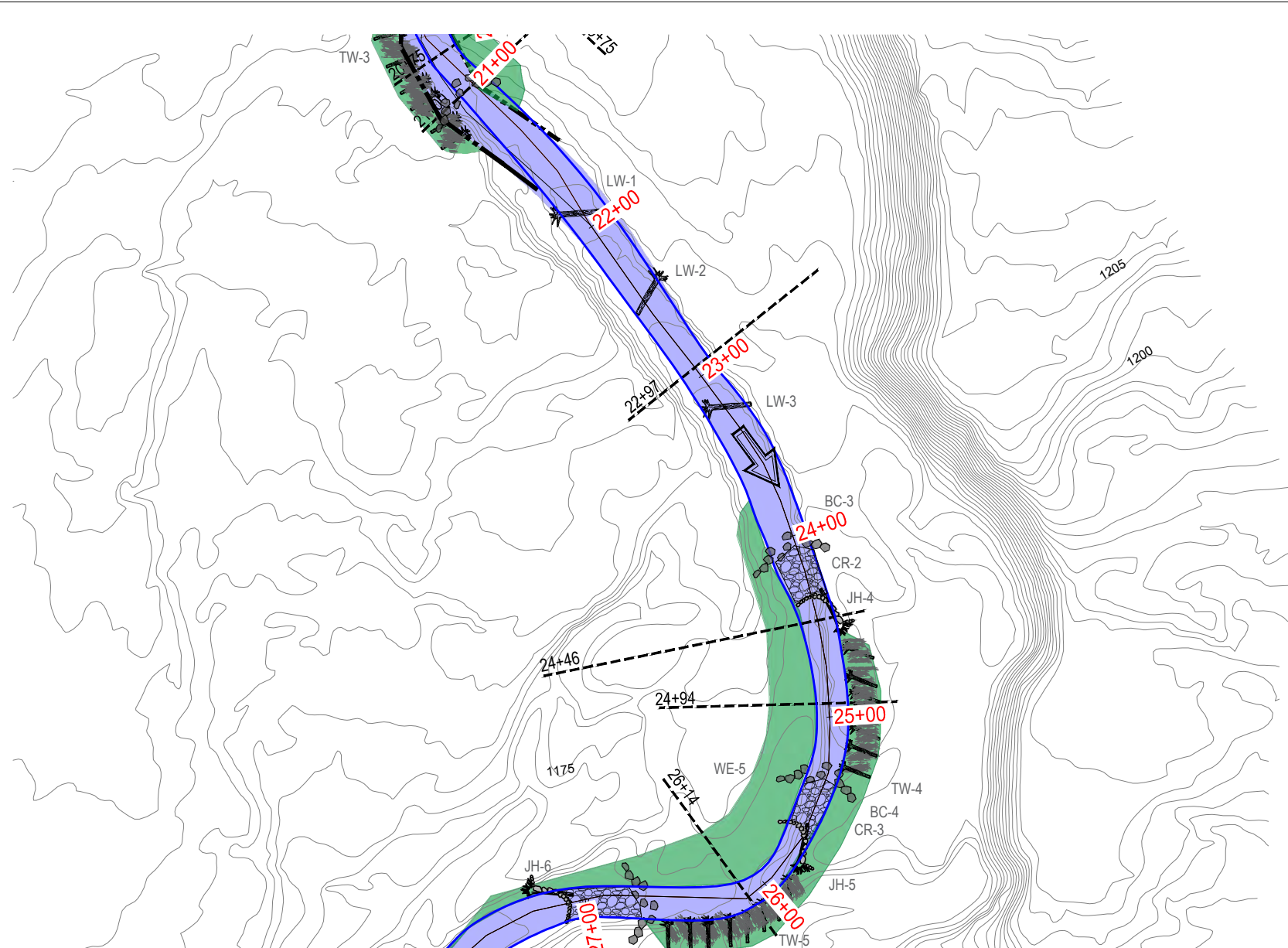
MADISON
640 COTTONWOOD DRIVE, SUITE A
FITCHBURG, WISCONSIN 53719
TEL. (608) 861-2365 FAX (608) 861-2361
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DATE | JANUARY 2020
DRAWN | MGS/COD
DESIGNED | ACS
CHECKED | I
PROJECT # | J188372100

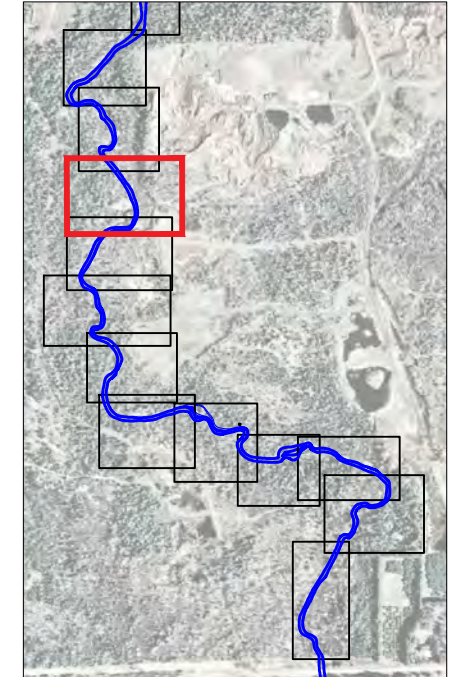
SHEET TITLE
AREA 3
SHEET NUMBER
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LAND USE #

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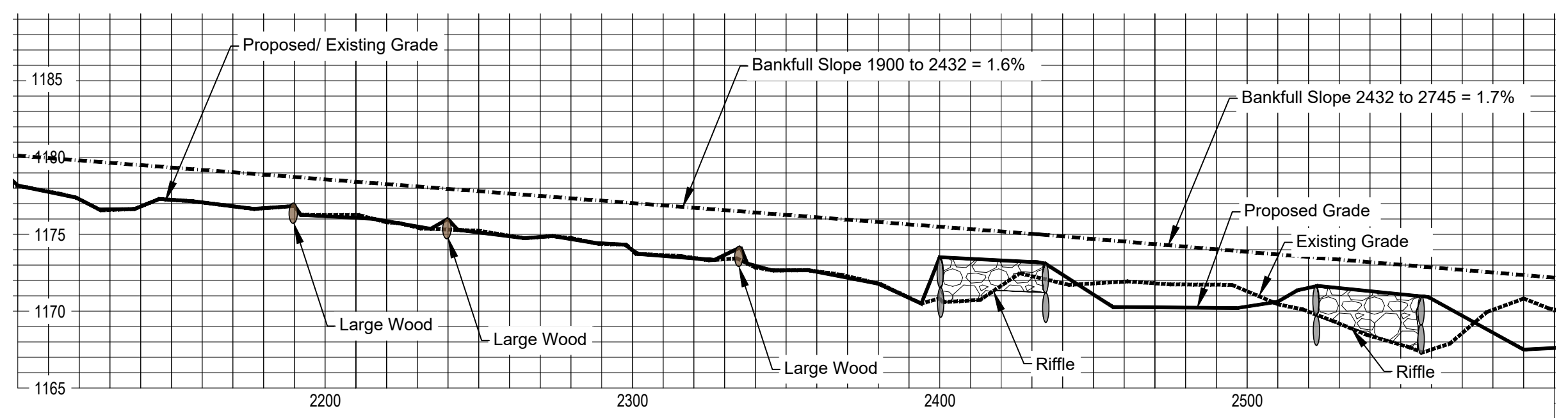
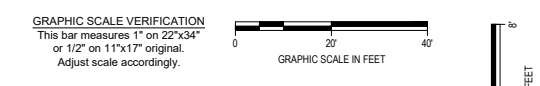
NOTE:
 1. Final position, orientation, and elevation of large wood additions to be determined in the field by on-site construction supervisor.

- LEGEND**
- EDGE OF WATER
 - EXISTING GRADE
 - DRAINAGE FLOW
 - TOEWOOD
 - J-HOOK
 - BOULDER CLUSTER
 - CROSS VANE
 - BANK GRADING
 - CHANNEL RE-ROUTE
 - SUBGRADE LOG VANE
 - LOG ROLLER
 - CHANNEL TO BE FILLED
 - CONSTRUCTED RIFFLE
 - LARGE WOOD HABITAT ENHANCEMENT



KEY MAP
 GRAPHIC SCALE VERIFICATION
 This bar measures 1" on 22"x34" or 1/2" on 11"x17" original.
 Adjust scale accordingly.

PROFILE 21+00 TO 26+00



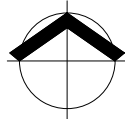
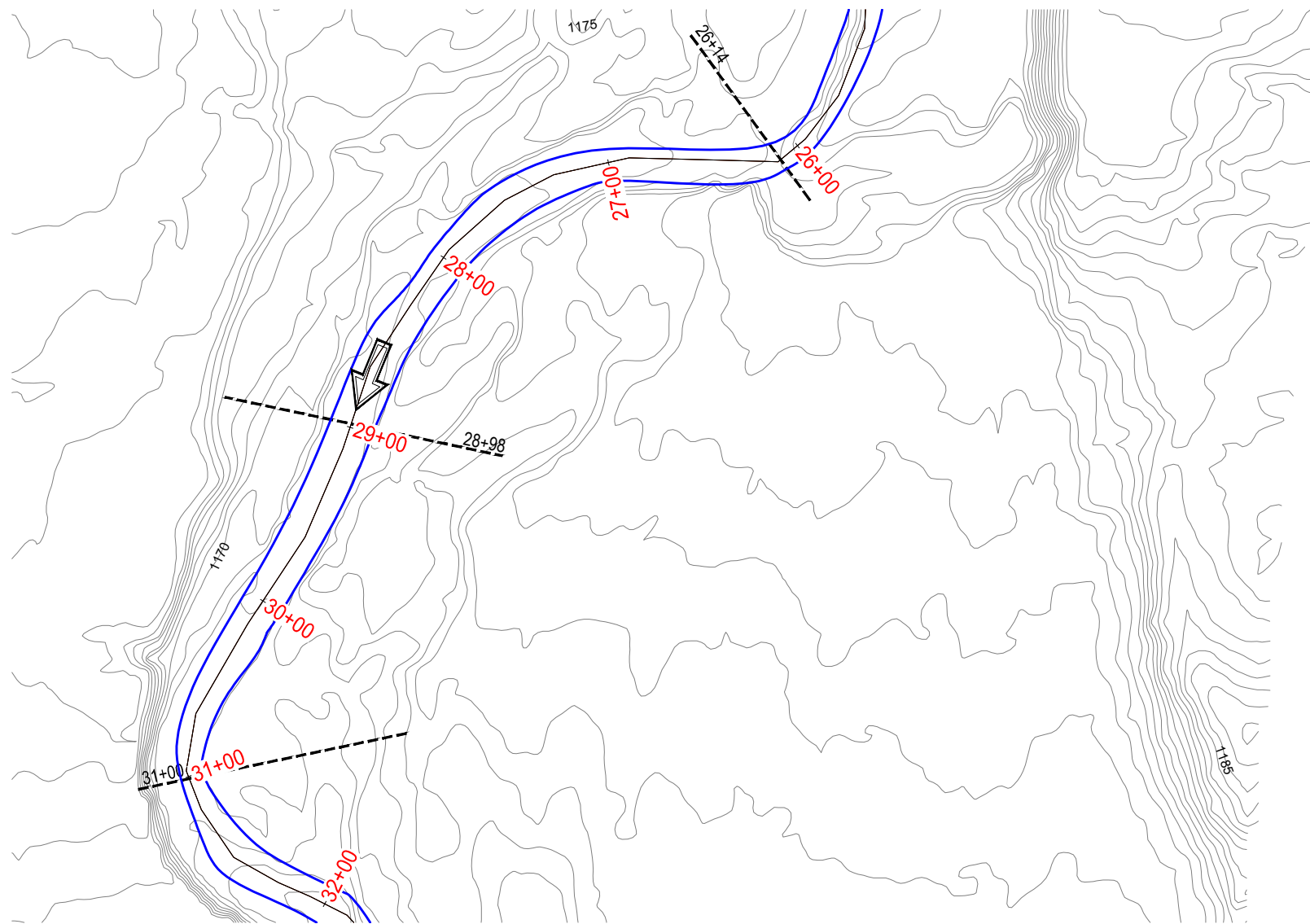
60% DESIGN

**AREA 3 PROPOSED PLAN
 KNIFE RIVER
 ENVIRONMENTAL TROUBLE SHOOTERS
 LAKE COUNTY, MINNESOTA**

#	DATE	DESCRIPTION

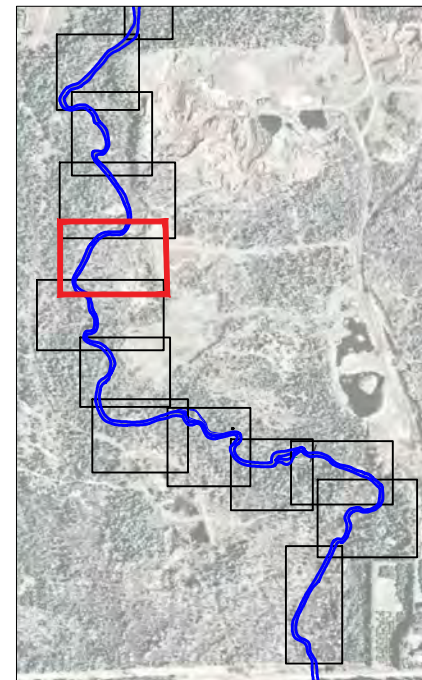
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DESIGNED	JACS
CHECKED	J
PROJECT #	J188372100
SHEET TITLE	AREA 3
SHEET NUMBER	11
LAND USE #	

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GRAPHIC SCALE IN FEET
 0 40 80
 GRAPHIC SCALE VERIFICATION
 This bar measures 1" on 22"x34"
 or 1/2" on 11"x17" original.
 Adjust scale accordingly.

- LEGEND
- EDGE OF WATER
 - EXISTING GRADE
 - DRAINAGE FLOW



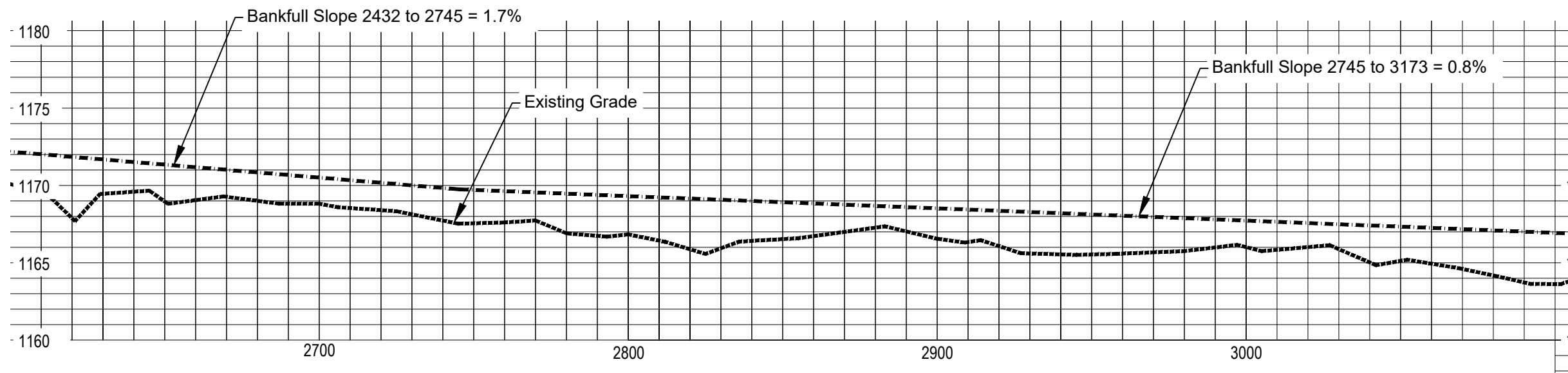
KEY MAP
 GRAPHIC SCALE VERIFICATION
 This bar measures 1" on 22"x34"
 or 1/2" on 11"x17" original.
 Adjust scale accordingly.

PROFILE 26+00 TO 31+00

GRAPHIC SCALE VERIFICATION
 This bar measures 1" on 22"x34"
 or 1/2" on 11"x17" original.
 Adjust scale accordingly.

0 20 40
 GRAPHIC SCALE IN FEET

0 4 8
 GRAPHIC SCALE IN FEET



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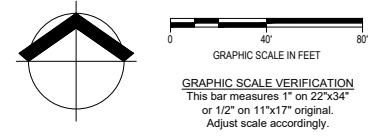
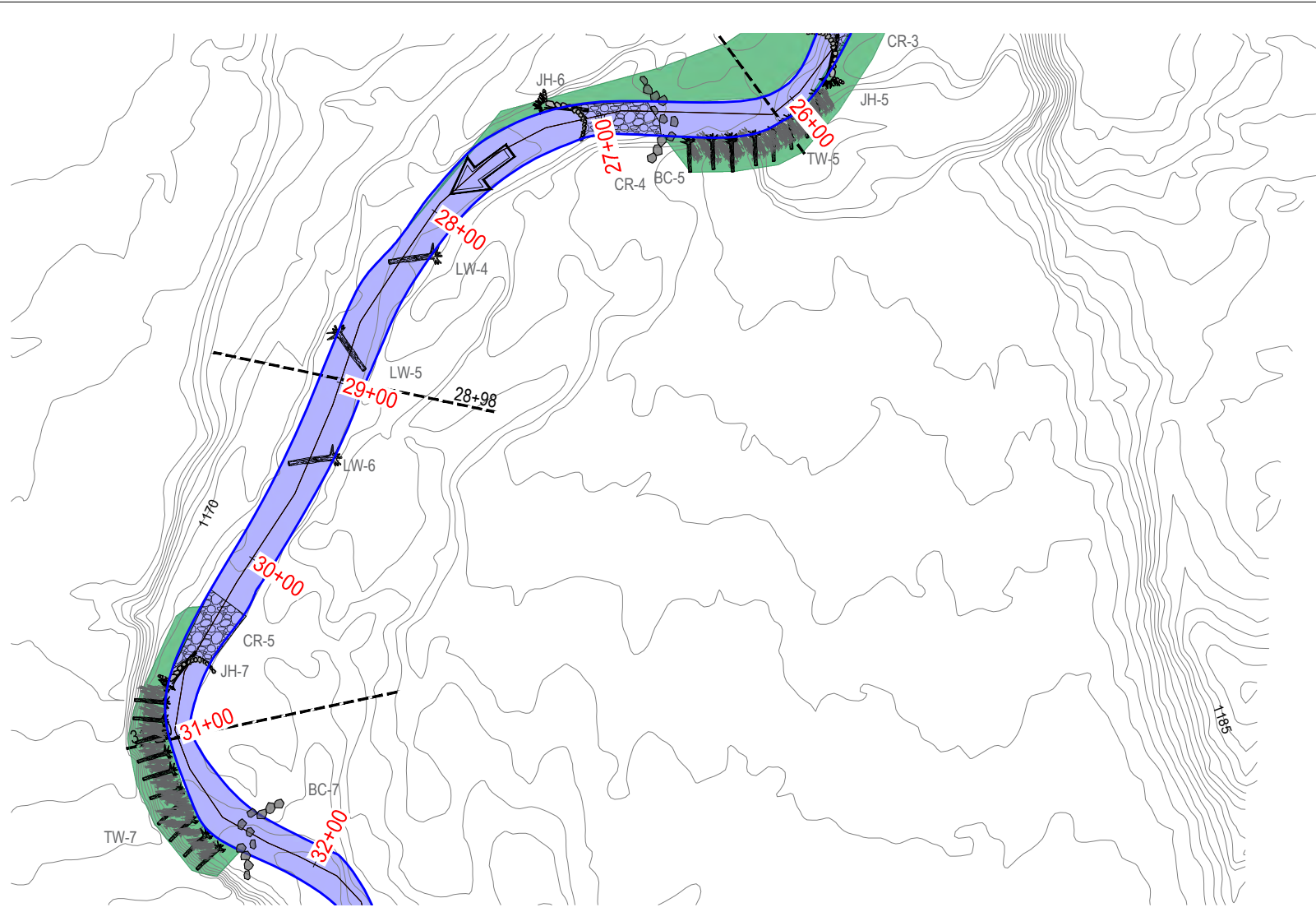
AREA 4 EXISTING CONDITIONS
 KNIFE RIVER
 ENVIRONMENTAL TROUBLE SHOOTERS
 LAKE COUNTY, MINNESOTA

NO.	DATE	DESCRIPTION

DATE | JANUARY 2020
 DRAWN | MGS/COD
 DESIGNED | JACS
 CHECKED | JACS
 PROJECT # | J188372100

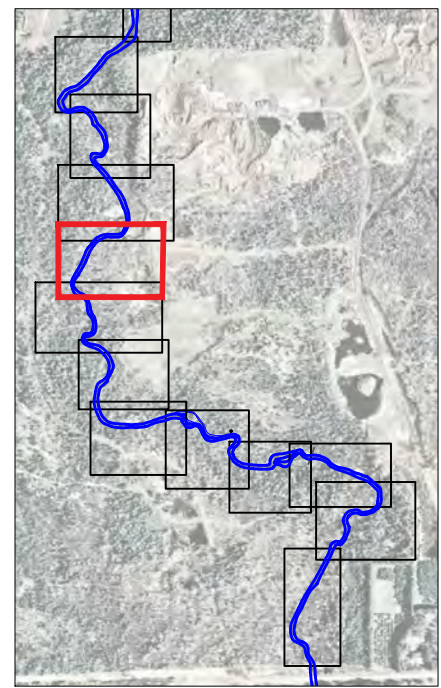
SHEET TITLE
AREA 4
 SHEET NUMBER
12
 LAND USE #

60% DESIGN



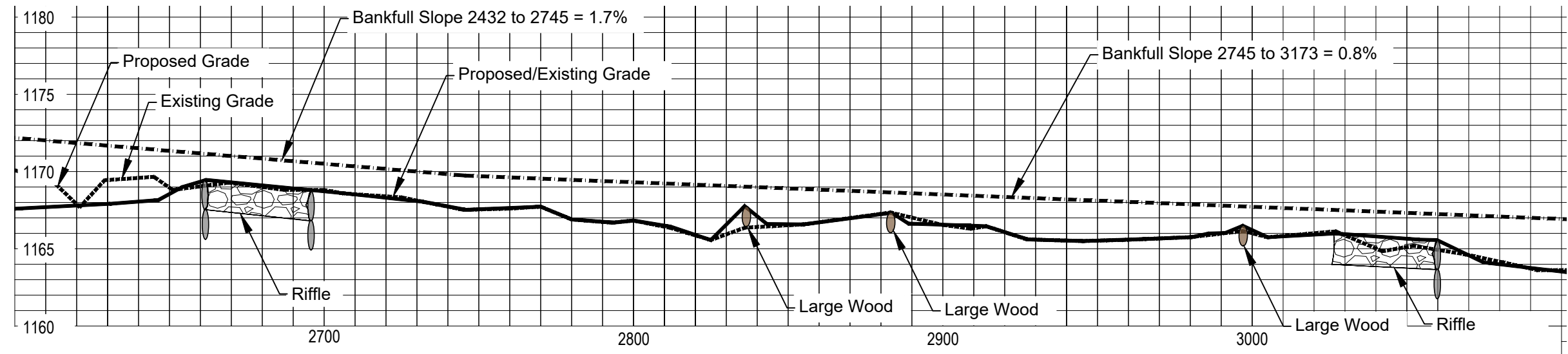
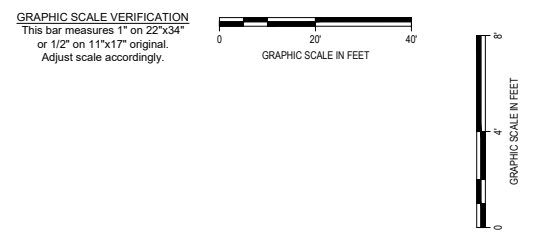
NOTE:
 1. Final position, orientation, and elevation of large wood additions to be determined in the field by on-site construction supervisor.

- LEGEND**
- EDGE OF WATER
 - EXISTING GRADE
 - DRAINAGE FLOW
 - TOEWOOD
 - J-HOOK
 - BOULDER CLUSTER
 - CROSS VANE
 - BANK GRADING
 - CHANNEL RE-ROUTE
 - SUBGRADE LOG VANE
 - LOG ROLLER
 - CHANNEL TO BE FILLED
 - CONSTRUCTED RIFFLE
 - LARGE WOOD HABITAT ENHANCEMENT



KEY MAP
 GRAPHIC SCALE VERIFICATION
 This bar measures 1" on 22"x34" or 1/2" on 11"x17" original.
 Adjust scale accordingly.

PROFILE 26+00 TO 31+00



60% DESIGN

AREA 4 PROPOSED PLAN

KNIFE RIVER ENVIRONMENTAL TROUBLE SHOOTERS LAKE COUNTY, MINNESOTA

#	DATE	DESCRIPTION

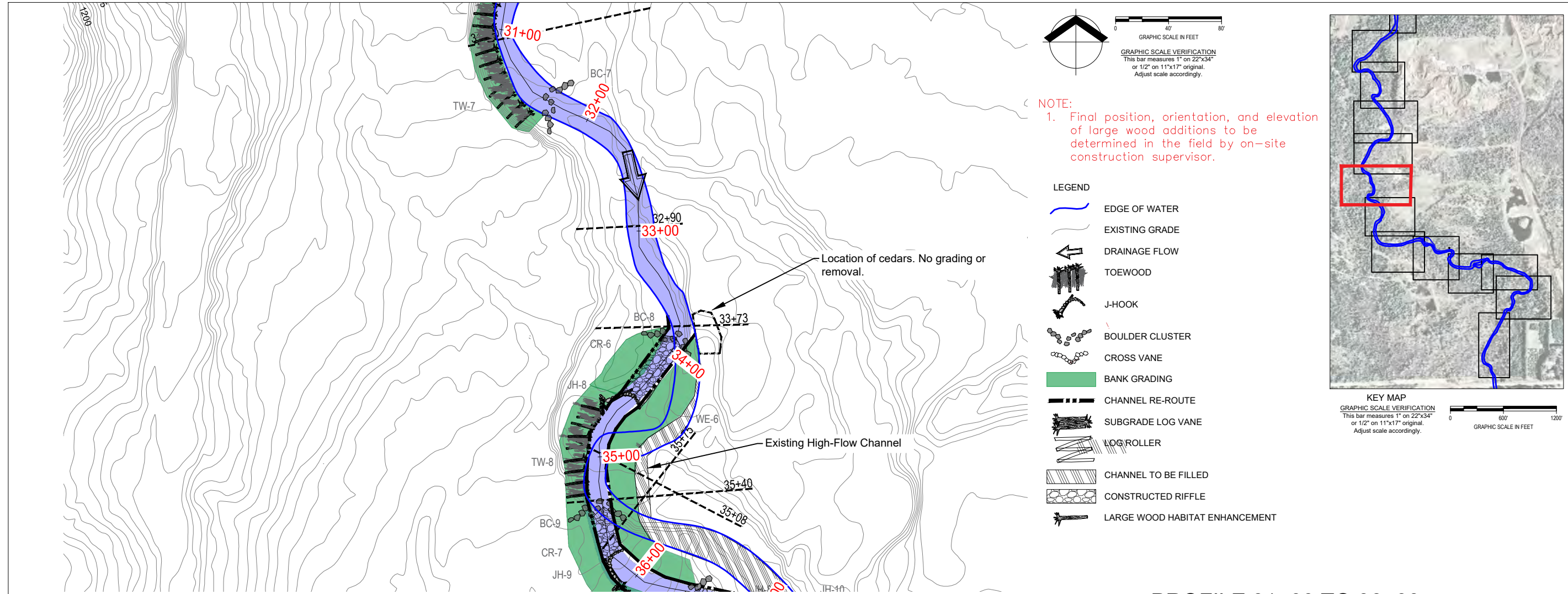
DATE	JANUARY 2020
DRAWN	JMGS/COD
DESIGNED	JACS
CHECKED	I
PROJECT #	J188372100

SHEET TITLE
AREA 4
 SHEET NUMBER

13

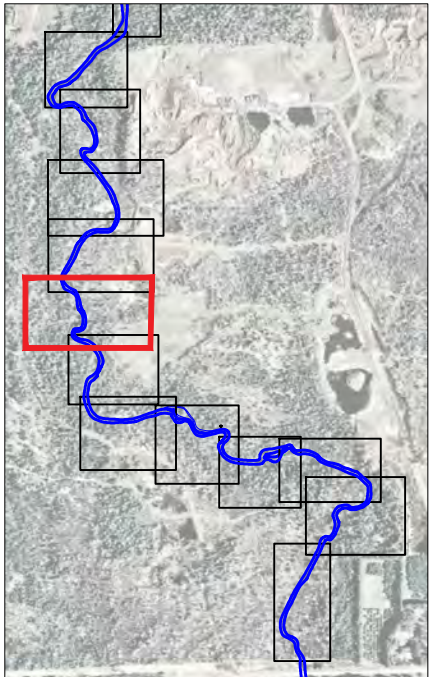
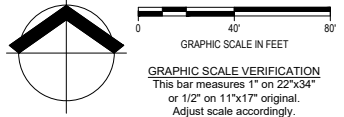
LAND USE #

R:\Project\1818372100_Env\TroubleShooters\Area4\Area4_Plan_Sheet.dwg - 10/20/20 1:08:48 PM



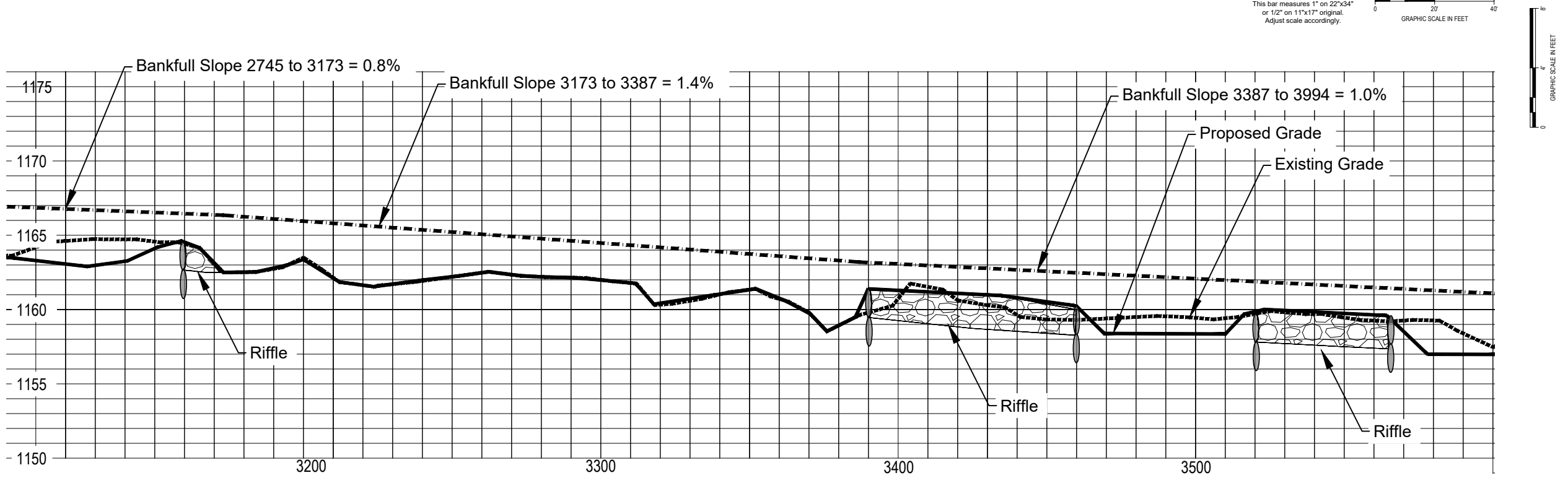
NOTE:
1. Final position, orientation, and elevation of large wood additions to be determined in the field by on-site construction supervisor.

- EDGE OF WATER
- - - EXISTING GRADE
- ← DRAINAGE FLOW
- █ TOEWOOD
- ◡ J-HOOK
- BOULDER CLUSTER
- CROSS VANE
- BANK GRADING
- - - CHANNEL RE-ROUTE
- ▨ SUBGRADE LOG VANE
- ▨ LOG ROLLER
- ▨ CHANNEL TO BE FILLED
- ▨ CONSTRUCTED RIFFLE
- █ LARGE WOOD HABITAT ENHANCEMENT



PROFILE 31+00 TO 36+00

GRAPHIC SCALE VERIFICATION
This bar measures 1" on 22"x34"
or 1/2" on 11"x17" original.
Adjust scale accordingly.

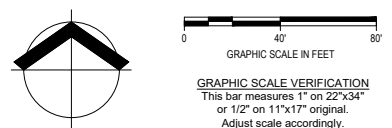
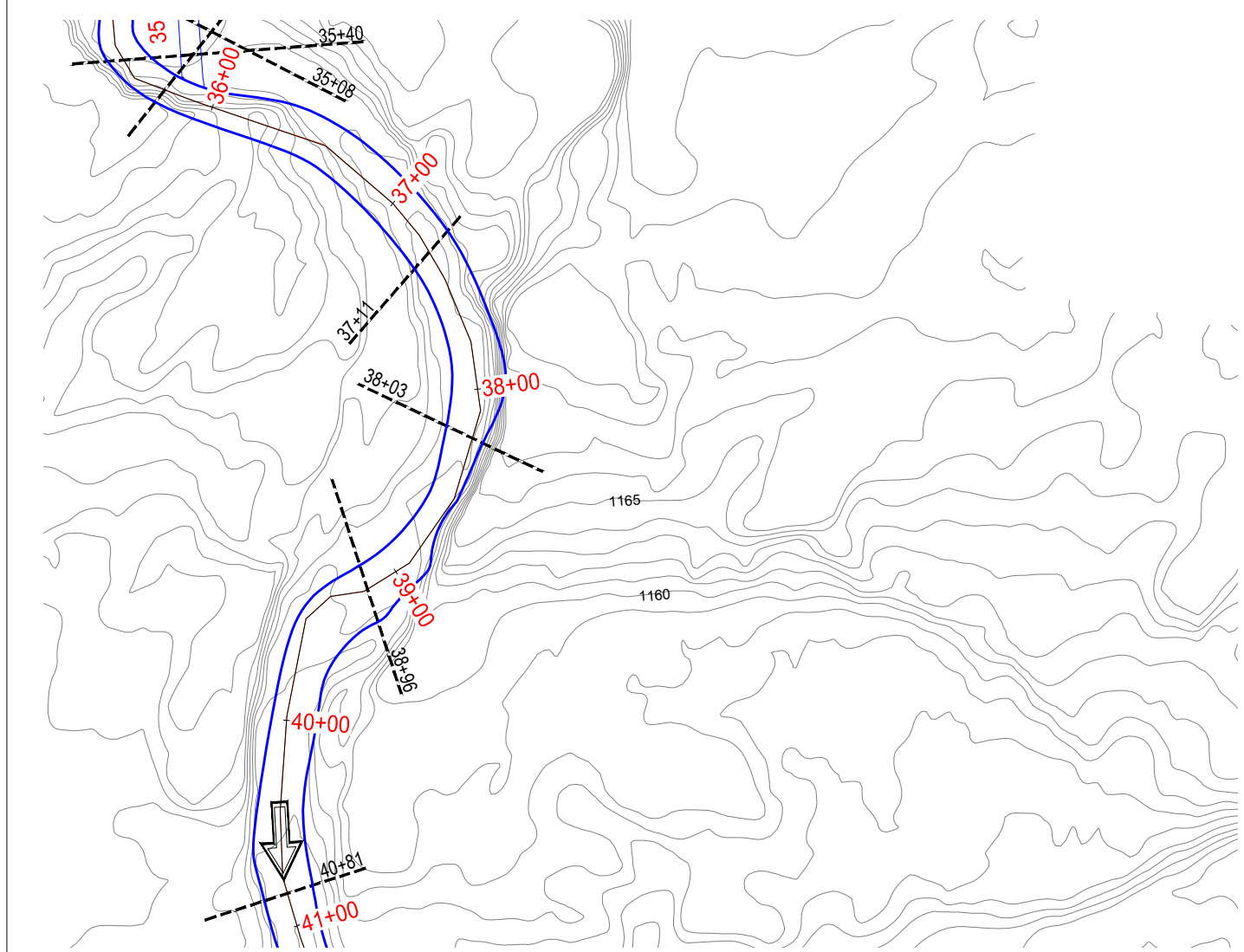


60% DESIGN

AREA 5 PROPOSED PLAN
KNIFE RIVER
ENVIRONMENTAL TROUBLE SHOOTERS
LAKE COUNTY, MINNESOTA

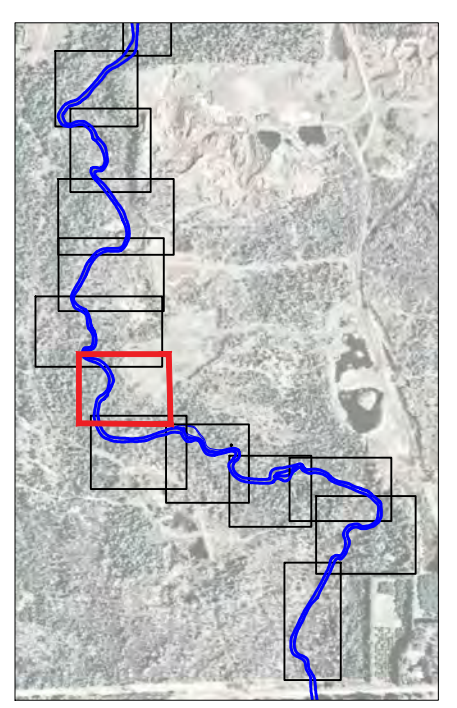
BY	DATE	DESCRIPTION

DATE	JANUARY 2020
DRAWN	JMG/CCD
DESIGNED	JACS
CHECKED	I
PROJECT #	J188372100
SHEET TITLE	AREA 5
SHEET NUMBER	15
LAND USE #	



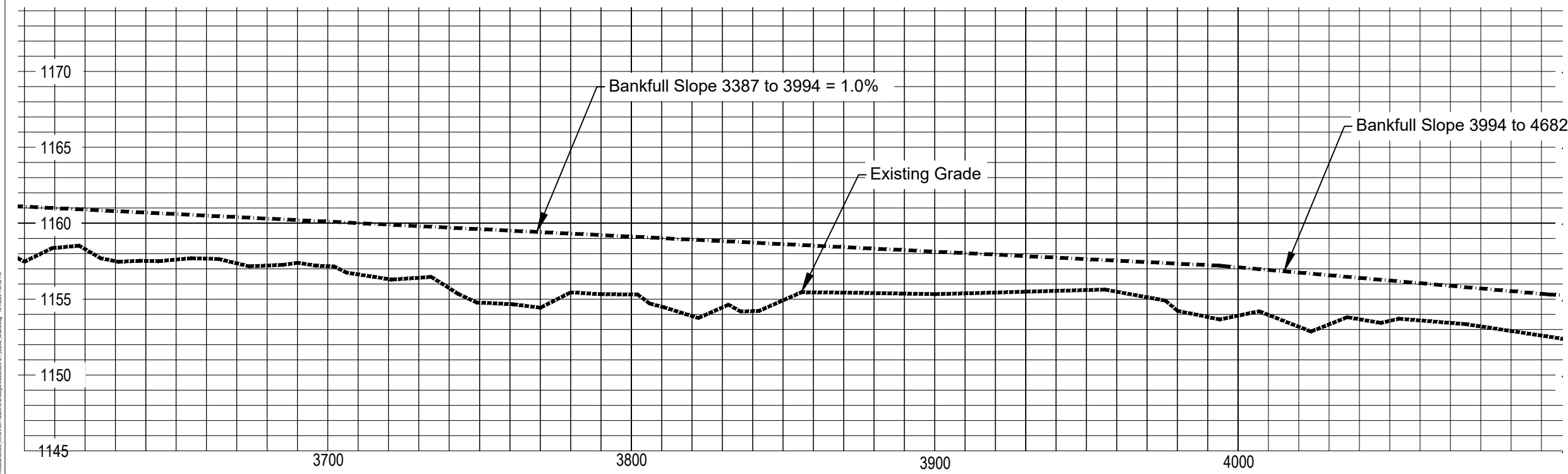
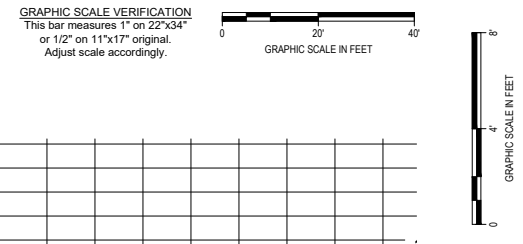
LEGEND

- EDGE OF WATER
- EXISTING GRADE
- DRAINAGE FLOW



KEY MAP
GRAPHIC SCALE VERIFICATION
This bar measures 1" on 22"x34"
or 1/2" on 11"x17" original.
Adjust scale accordingly.

PROFILE 36+00 TO 41+00



R:\Projects\1818837100_Environmental\GIS\MapDocs\1818837100_Sht_16.dwg - 1/12/2021 1:58:30 PM

60% DESIGN

**AREA 6 EXISTING CONDITIONS
KNIFE RIVER
ENVIRONMENTAL TROUBLE SHOOTERS
LAKE COUNTY, MINNESOTA**

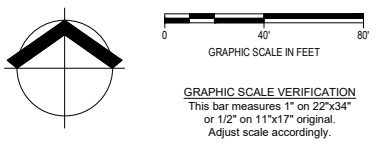
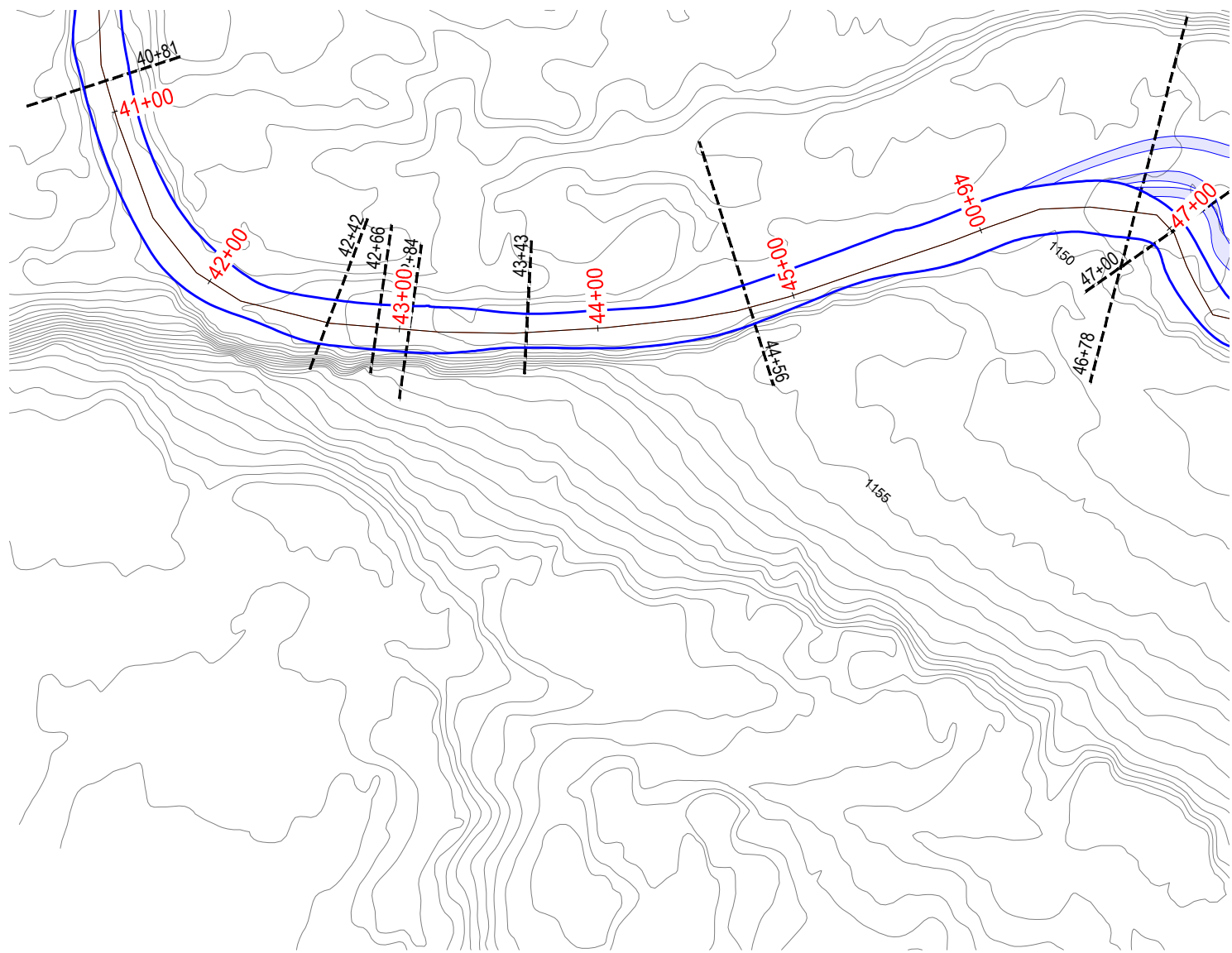
#	DATE	DESCRIPTION

DATE	JANUARY 2020
DRAWN	JMSS/CDD
DESIGNED	JACS
CHECKED	I
PROJECT #	J188372100

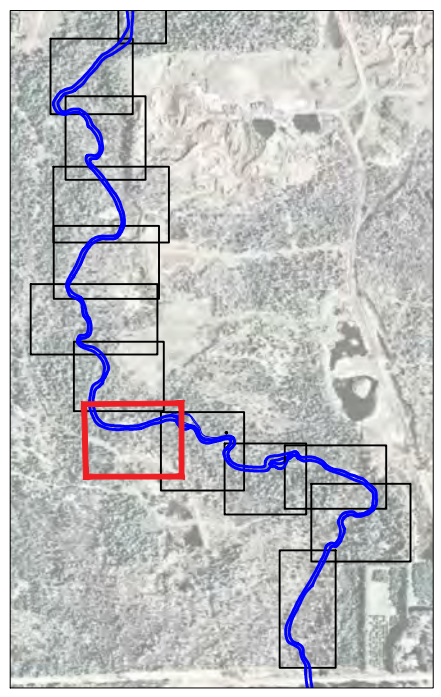
SHEET TITLE
AREA 6

SHEET NUMBER
16

LAND USE #

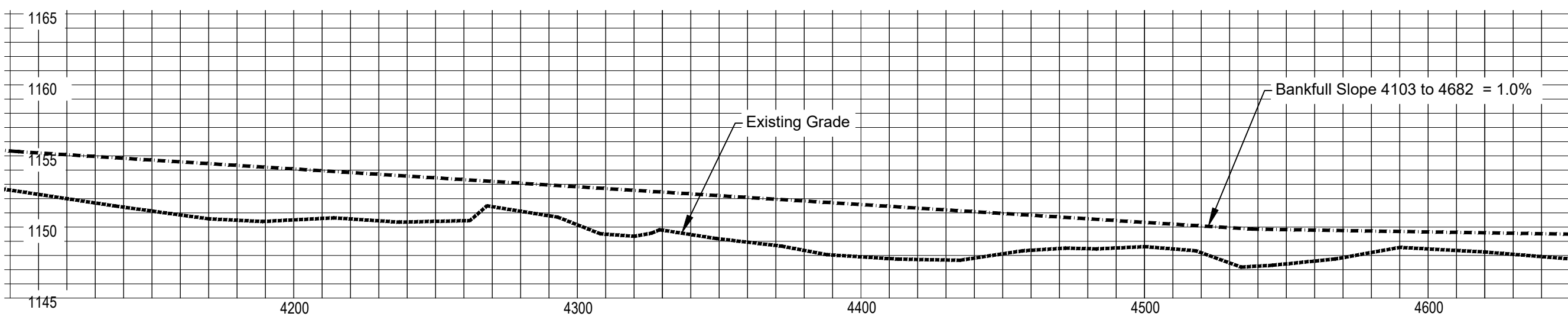
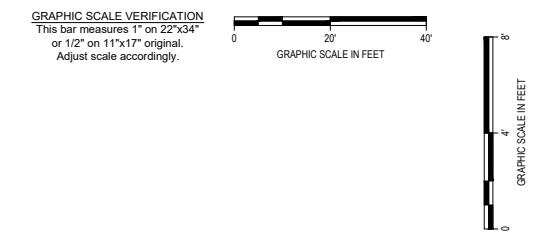


- LEGEND
- EDGE OF WATER
 - EXISTING GRADE
 - DRAINAGE FLOW



KEY MAP
 GRAPHIC SCALE VERIFICATION
 This bar measures 1" on 22"x34"
 or 1/2" on 11"x17" original.
 Adjust scale accordingly.

PROFILE 41+00 TO 46+50

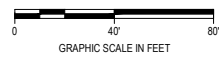
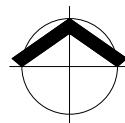
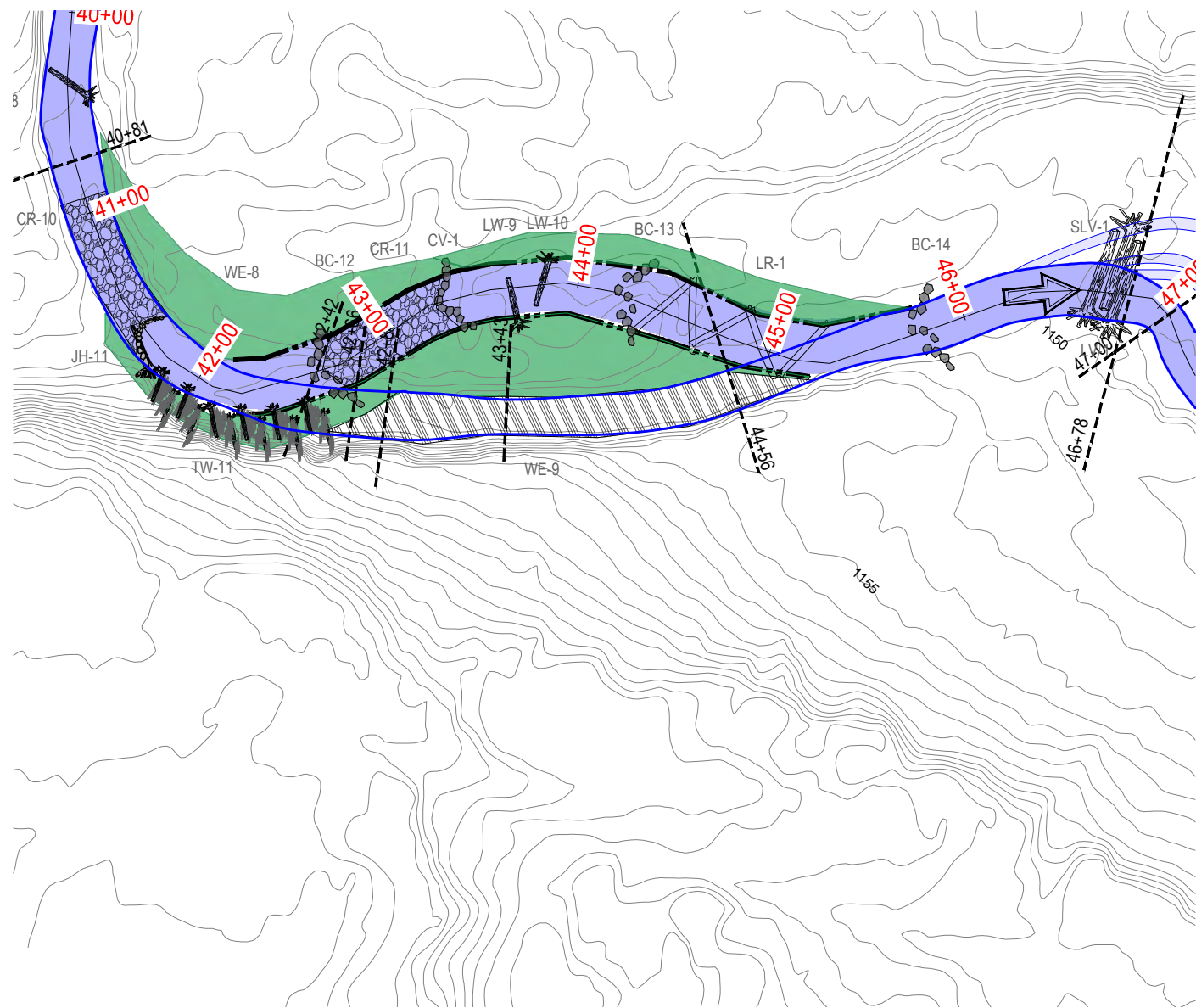


60% DESIGN

AREA 7 EXISTING CONDITIONS
 KNIFE RIVER
 ENVIRONMENTAL TROUBLE SHOOTERS
 LAKE COUNTY, MINNESOTA

BY	DATE	DESCRIPTION

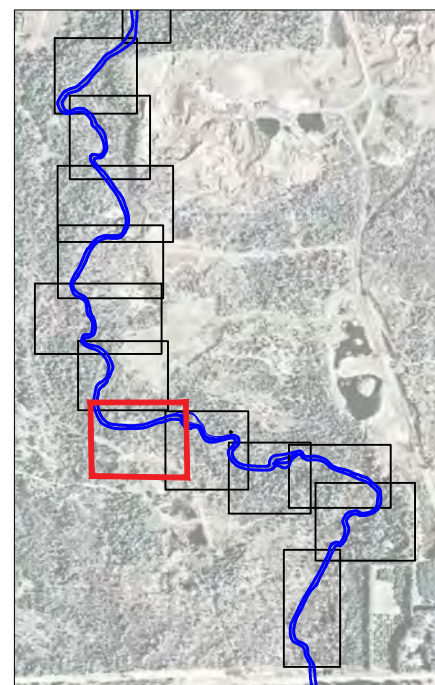
R:\Project\18188372100_Env\TroubleShooters_KnifeRiver\Area7\60%Design\2020\01_Layer_Sheets.dwg - 1/13/2020 1:58:00 PM



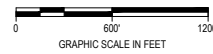
GRAPHIC SCALE VERIFICATION
 This bar measures 1" on 22"x34"
 or 1/2" on 11"x17" original.
 Adjust scale accordingly.

NOTE:
 1. Final position, orientation, and elevation of large wood additions to be determined in the field by on-site construction supervisor.

- LEGEND
- EDGE OF WATER
 - EXISTING GRADE
 - DRAINAGE FLOW
 - TOEWOOD
 - J-HOOK
 - BOULDER CLUSTER
 - CROSS VANE
 - BANK GRADING
 - CHANNEL RE-ROUTE
 - SUBGRADE LOG VANE
 - LOG ROLLER
 - CHANNEL TO BE FILLED
 - CONSTRUCTED RIFFLE
 - LARGE WOOD HABITAT ENHANCEMENT

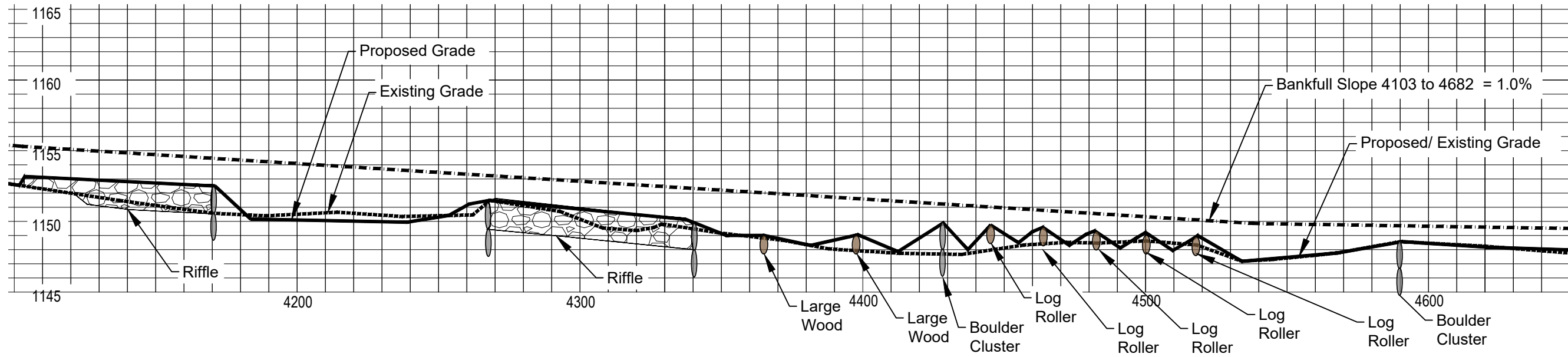
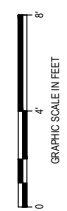
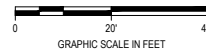


KEY MAP
 GRAPHIC SCALE VERIFICATION
 This bar measures 1" on 22"x34"
 or 1/2" on 11"x17" original.
 Adjust scale accordingly.



PROFILE 41+00 TO 46+50

GRAPHIC SCALE VERIFICATION
 This bar measures 1" on 22"x34"
 or 1/2" on 11"x17" original.
 Adjust scale accordingly.



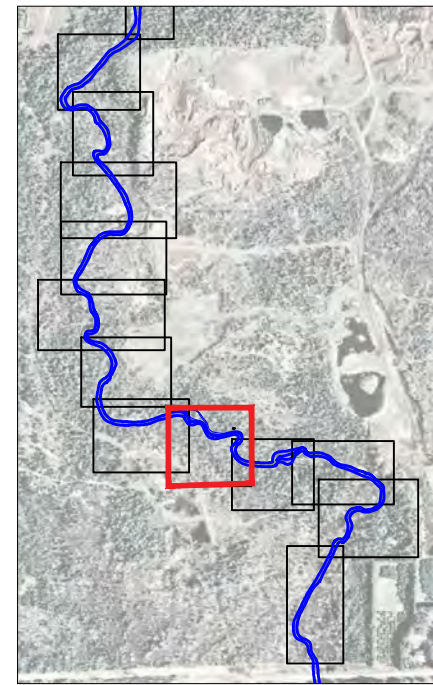
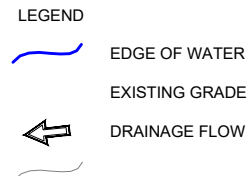
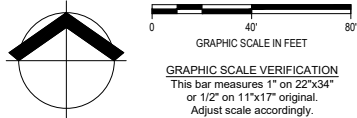
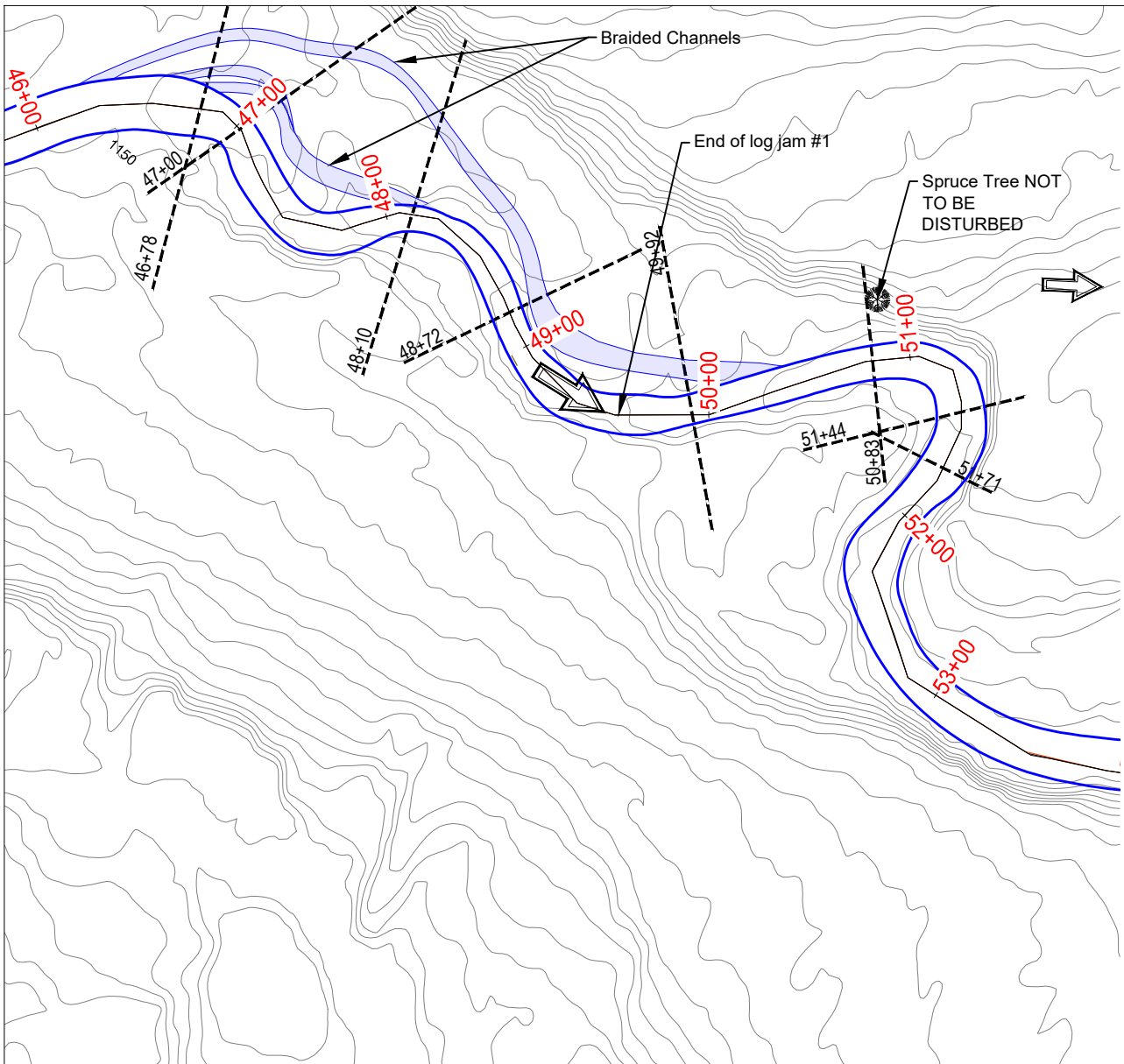
60% DESIGN

AREA 7 PROPOSED PLAN KNIFE RIVER ENVIRONMENTAL TROUBLE SHOOTERS LAKE COUNTY, MINNESOTA

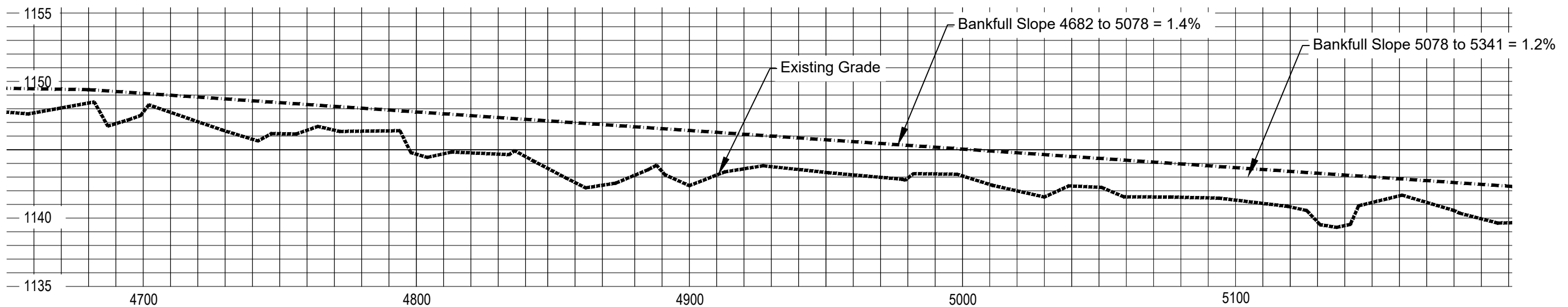
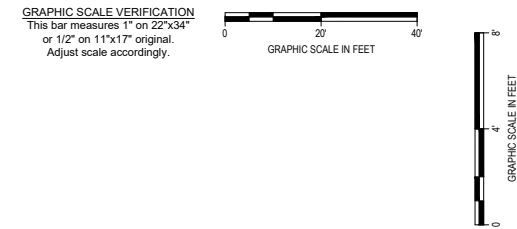
#	DATE	DESCRIPTION

DATE | JANUARY 2020
 DRAWN | MGS/COD
 DESIGNED | ACS
 CHECKED | I
 PROJECT # | J188372100

SHEET TITLE
AREA 7
 SHEET NUMBER
19
 LAND USE #



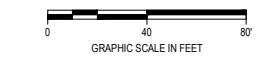
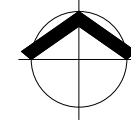
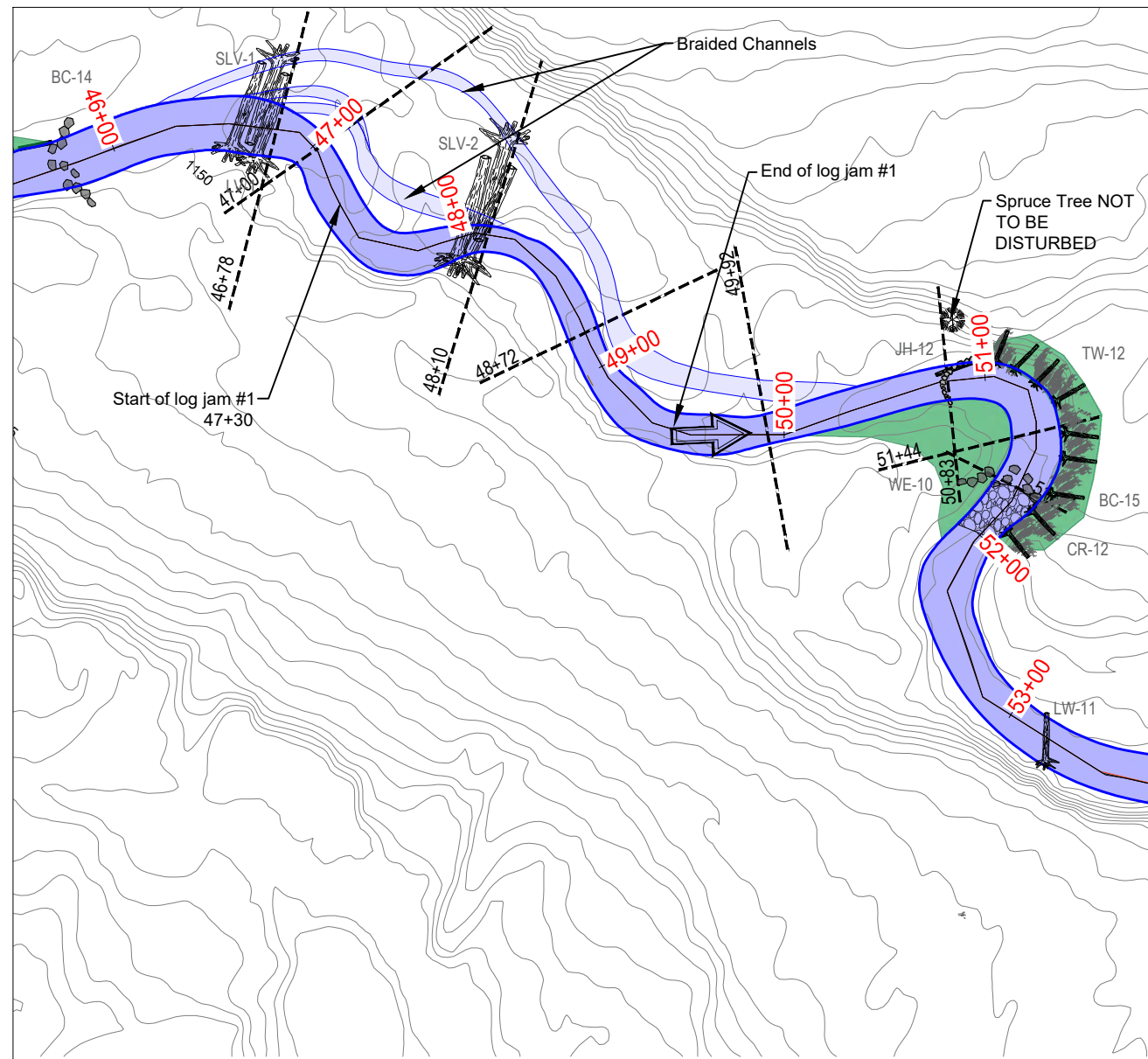
PROFILE 46+50 TO 52+00



60% DESIGN

BY	DATE	DESCRIPTION

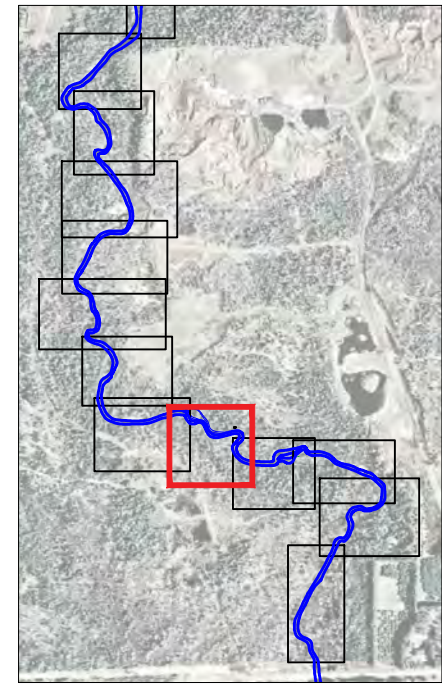
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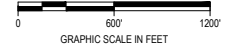
GRAPHIC SCALE VERIFICATION
This bar measures 1" on 22"x34"
or 1/2" on 11"x17" original.
Adjust scale accordingly.

- LEGEND**
- EDGE OF WATER
 - EXISTING GRADE
 - DRAINAGE FLOW
 - TOEWOOD
 - J-HOOK
 - BOULDER CLUSTER
 - CROSS VANE
 - BANK GRADING
 - CHANNEL RE-ROUTE
 - SUBGRADE LOG VANE
 - LOG ROLLER
 - CHANNEL TO BE FILLED
 - CONSTRUCTED RIFFLE
 - LARGE WOOD HABITAT ENHANCEMENT

NOTE:
1. Final position, orientation, and elevation of large wood additions to be determined in the field by on-site construction supervisor.

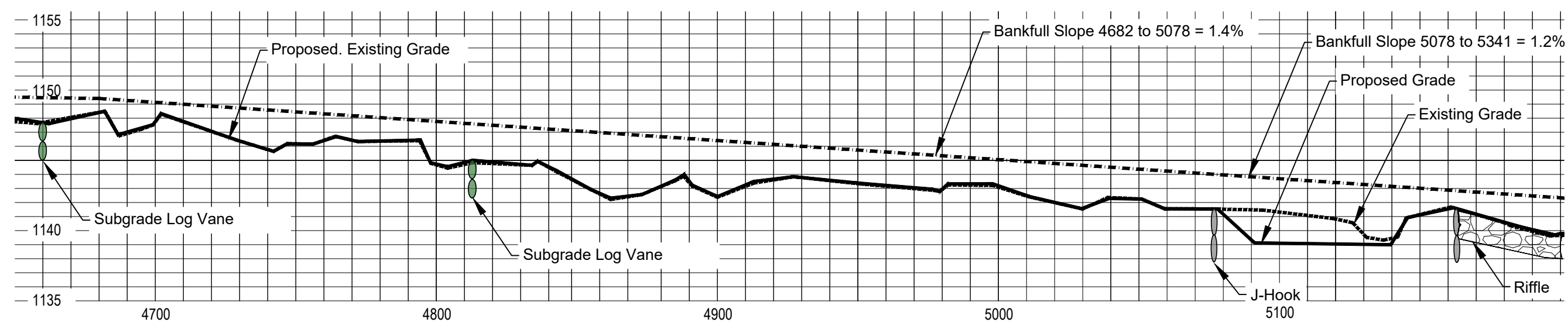
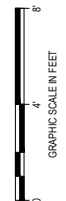
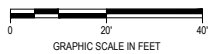


KEY MAP
GRAPHIC SCALE VERIFICATION
This bar measures 1" on 22"x34"
or 1/2" on 11"x17" original.
Adjust scale accordingly.



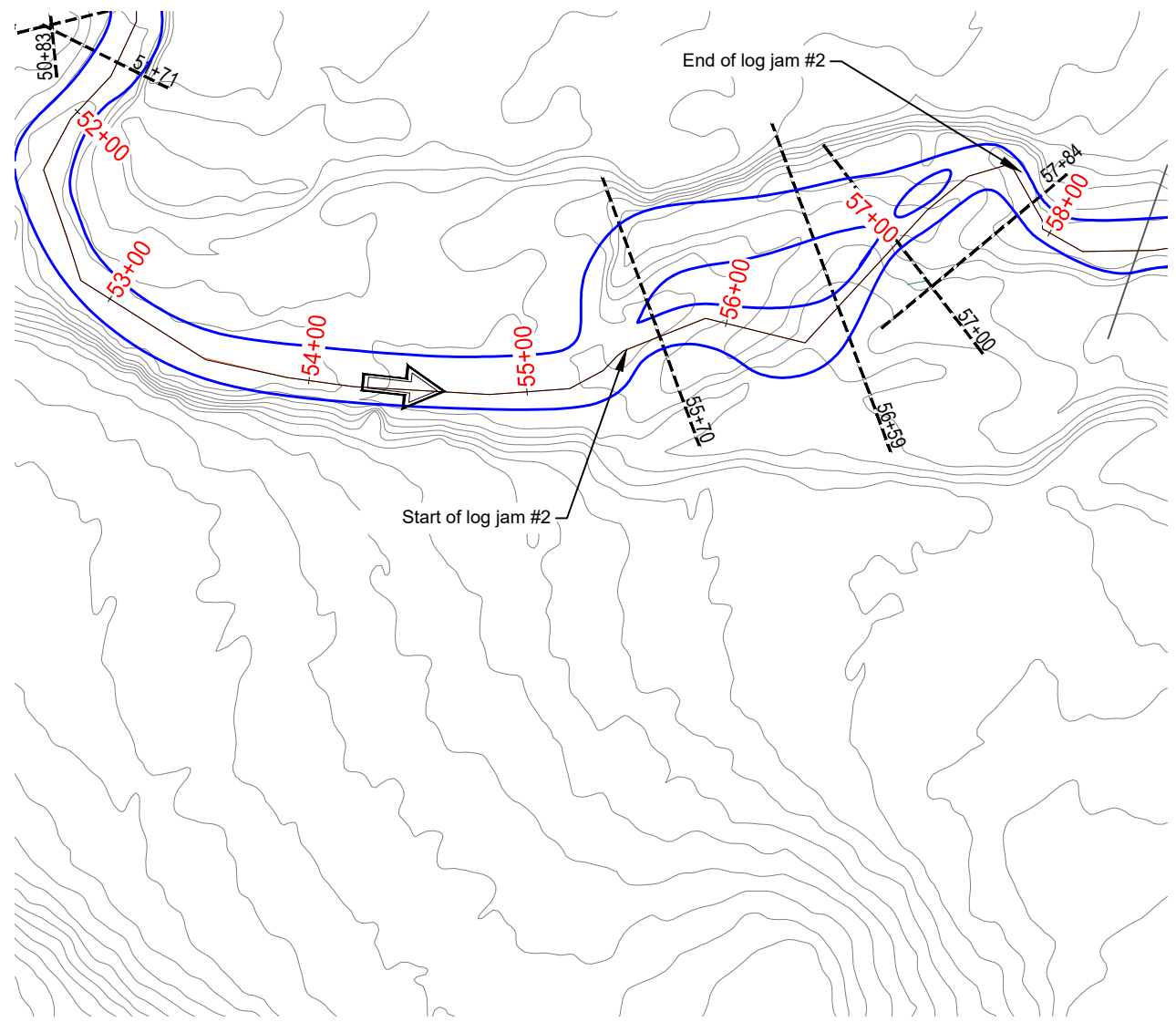
PROFILE 46+50 TO 52+00

GRAPHIC SCALE VERIFICATION
This bar measures 1" on 22"x34"
or 1/2" on 11"x17" original.
Adjust scale accordingly.



60% DESIGN

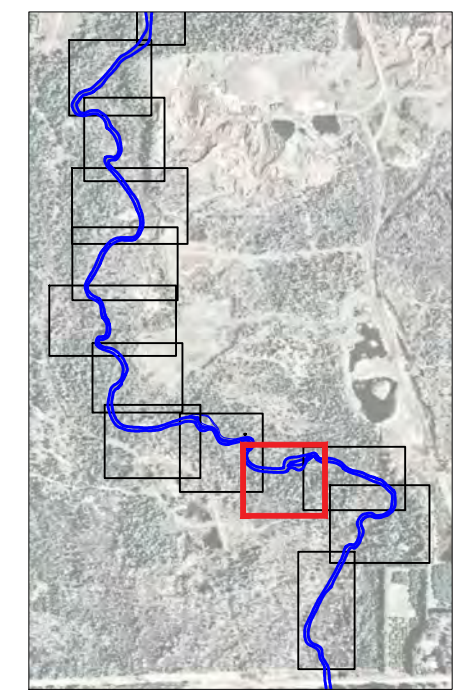
#	DATE	DESCRIPTION



0 40 80
GRAPHIC SCALE IN FEET

GRAPHIC SCALE VERIFICATION
This bar measures 1" on 22"x34"
or 1/2" on 11"x17" original.
Adjust scale accordingly.

- LEGEND
- EDGE OF WATER
 - EXISTING GRADE
 - DRAINAGE FLOW



KEY MAP
GRAPHIC SCALE VERIFICATION
This bar measures 1" on 22"x34"
or 1/2" on 11"x17" original.
Adjust scale accordingly.

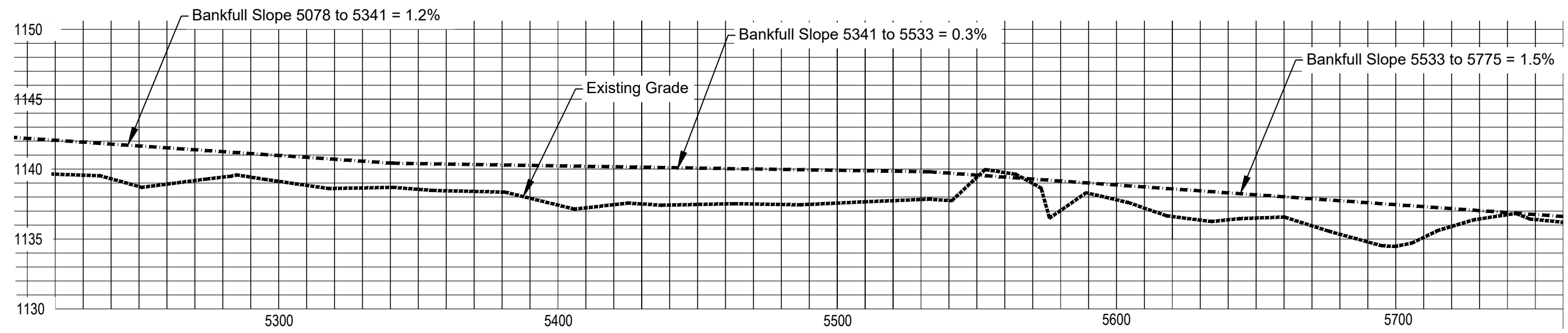
0 600 1200
GRAPHIC SCALE IN FEET

PROFILE 52+00 TO 57+50

GRAPHIC SCALE VERIFICATION
This bar measures 1" on 22"x34"
or 1/2" on 11"x17" original.
Adjust scale accordingly.

0 20 40
GRAPHIC SCALE IN FEET

0 4 8
GRAPHIC SCALE IN FEET



60% DESIGN

#	DATE	DESCRIPTION

DATE	JANUARY 2020
DRAWN	MGS/COD
DESIGNED	JACS
CHECKED	I
PROJECT #	J188372100

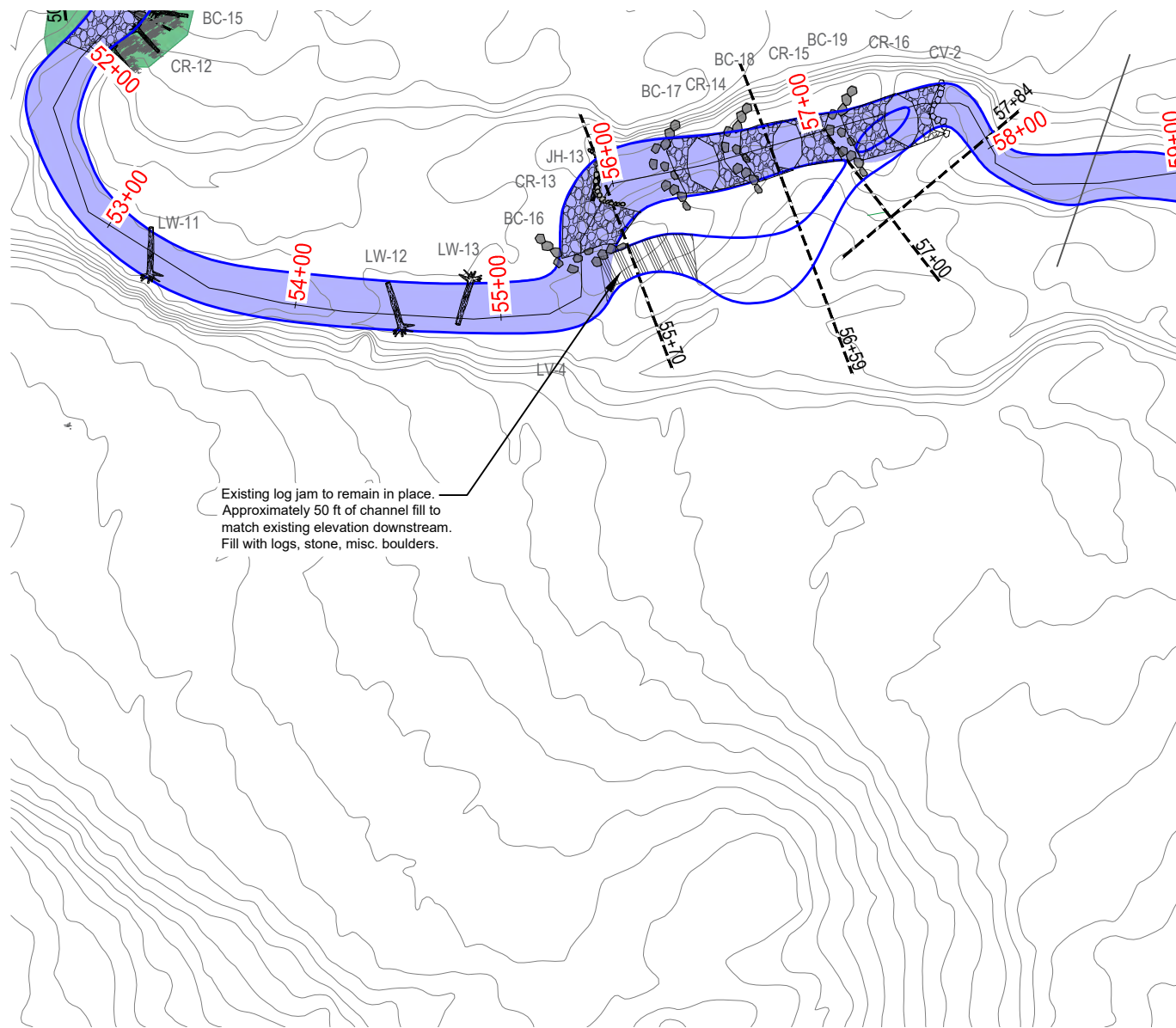
SHEET TITLE
AREA 9

SHEET NUMBER
22

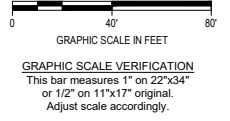
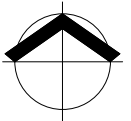
LAND USE #

AREA 9 EXISTING CONDITIONS
KNIFE RIVER
ENVIRONMENTAL TROUBLE SHOOTERS
LAKE COUNTY, MINNESOTA

R:\Project\18188372100_Env\TroubleShooters_KnifeRiver\Area9\CD\Area9\Area9_20200127_Layer_Sheets.dwg - 1/13/2020 1:06:46 PM

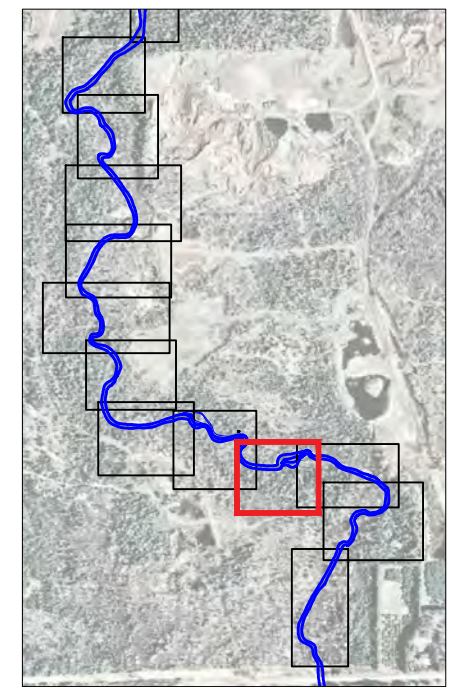


Existing log jam to remain in place. Approximately 50 ft of channel fill to match existing elevation downstream. Fill with logs, stone, misc. boulders.



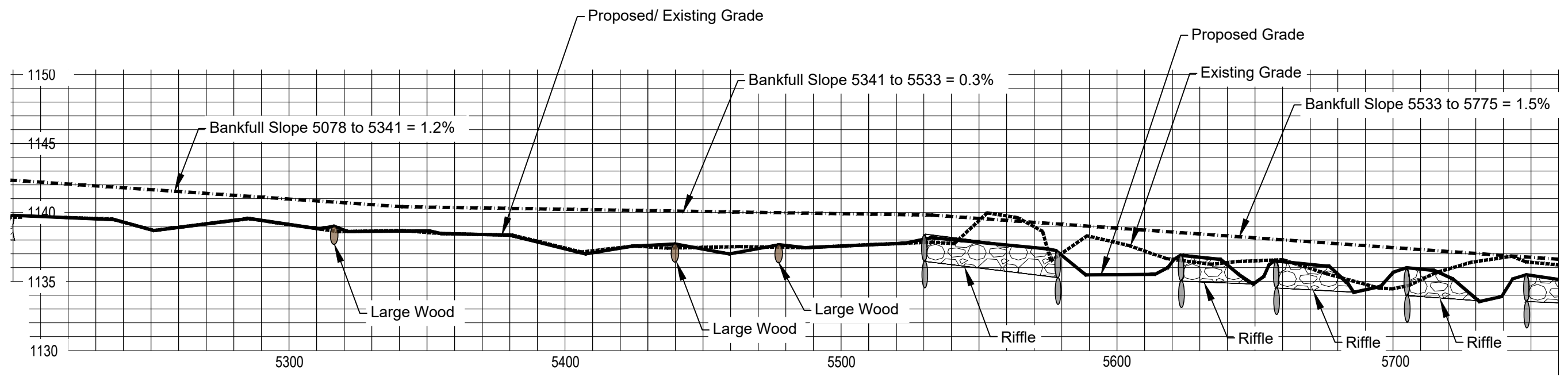
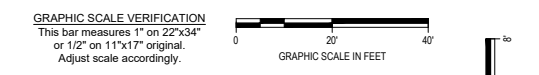
NOTE:
1. Final position, orientation, and elevation of large wood additions to be determined in the field by on-site construction supervisor.

- LEGEND**
- EDGE OF WATER
 - EXISTING GRADE
 - DRAINAGE FLOW
 - TOEWOOD
 - J-HOOK
 - BOULDER CLUSTER
 - CROSS VANE
 - BANK GRADING
 - CHANNEL RE-ROUTE
 - SUBGRADE LOG VANE
 - LOG ROLLER
 - CHANNEL TO BE FILLED
 - CONSTRUCTED RIFFLE
 - LARGE WOOD HABITAT ENHANCEMENT



KEY MAP
GRAPHIC SCALE VERIFICATION
This bar measures 1" on 22"x34" or 1/2" on 11"x17" original. Adjust scale accordingly.

PROFILE 52+00 TO 57+50



AREA 9 PROPOSED PLAN

**KNIFE RIVER
ENVIRONMENTAL TROUBLE SHOOTERS
LAKE COUNTY, MINNESOTA**

#	DATE	DESCRIPTION

DATE	JANUARY 2020
DRAWN	JMGS/COD
DESIGNED	JACS
CHECKED	I
PROJECT #	J188372100

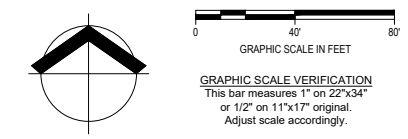
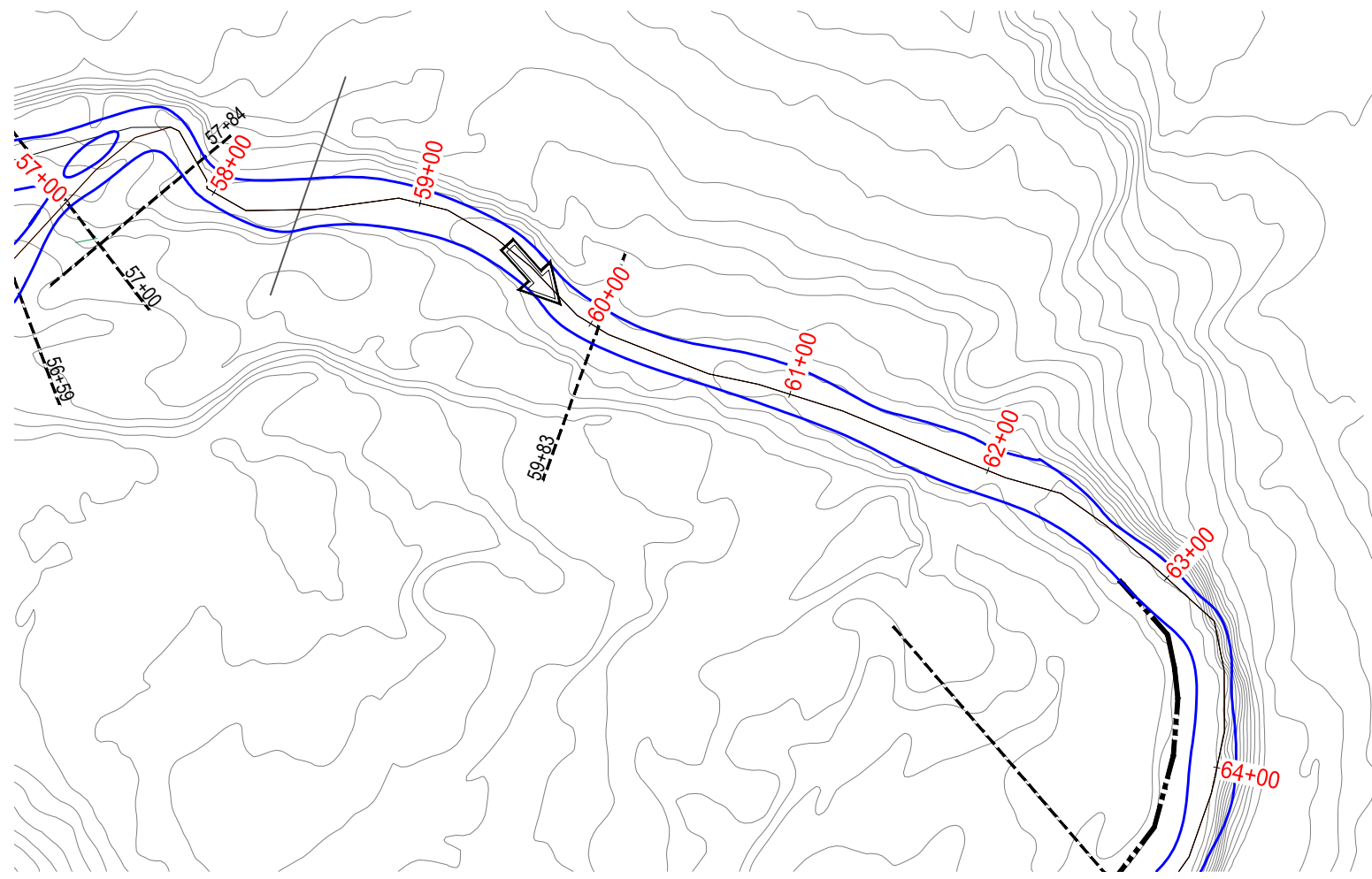
SHEET TITLE
AREA 9
SHEET NUMBER

23

LAND USE #

60% DESIGN

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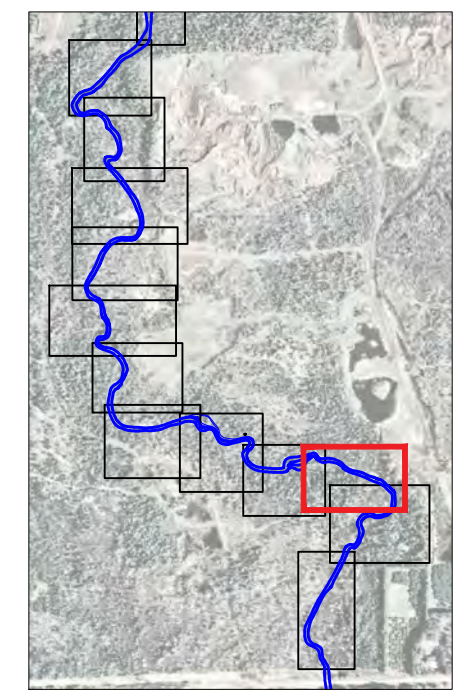


LEGEND

EDGE OF WATER

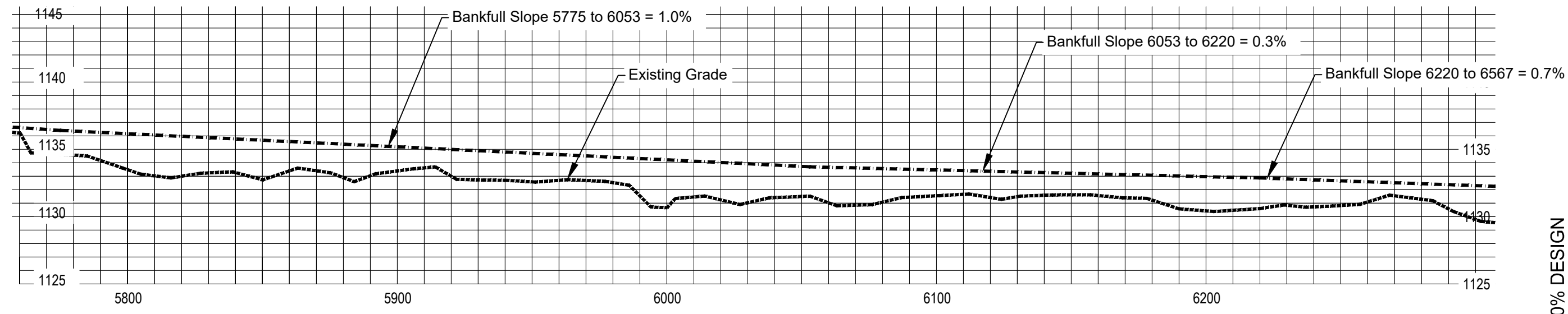
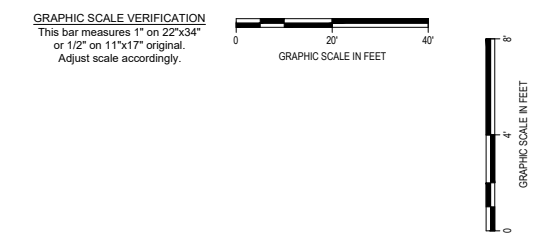
EXISTING GRADE

DRAINAGE FLOW



KEY MAP
 GRAPHIC SCALE VERIFICATION
 This bar measures 1" on 22"x34"
 or 1/2" on 11"x17" original.
 Adjust scale accordingly.

PROFILE 57+50 TO 63+00

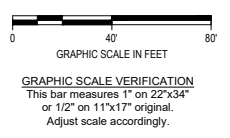
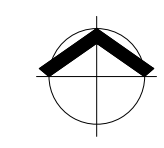
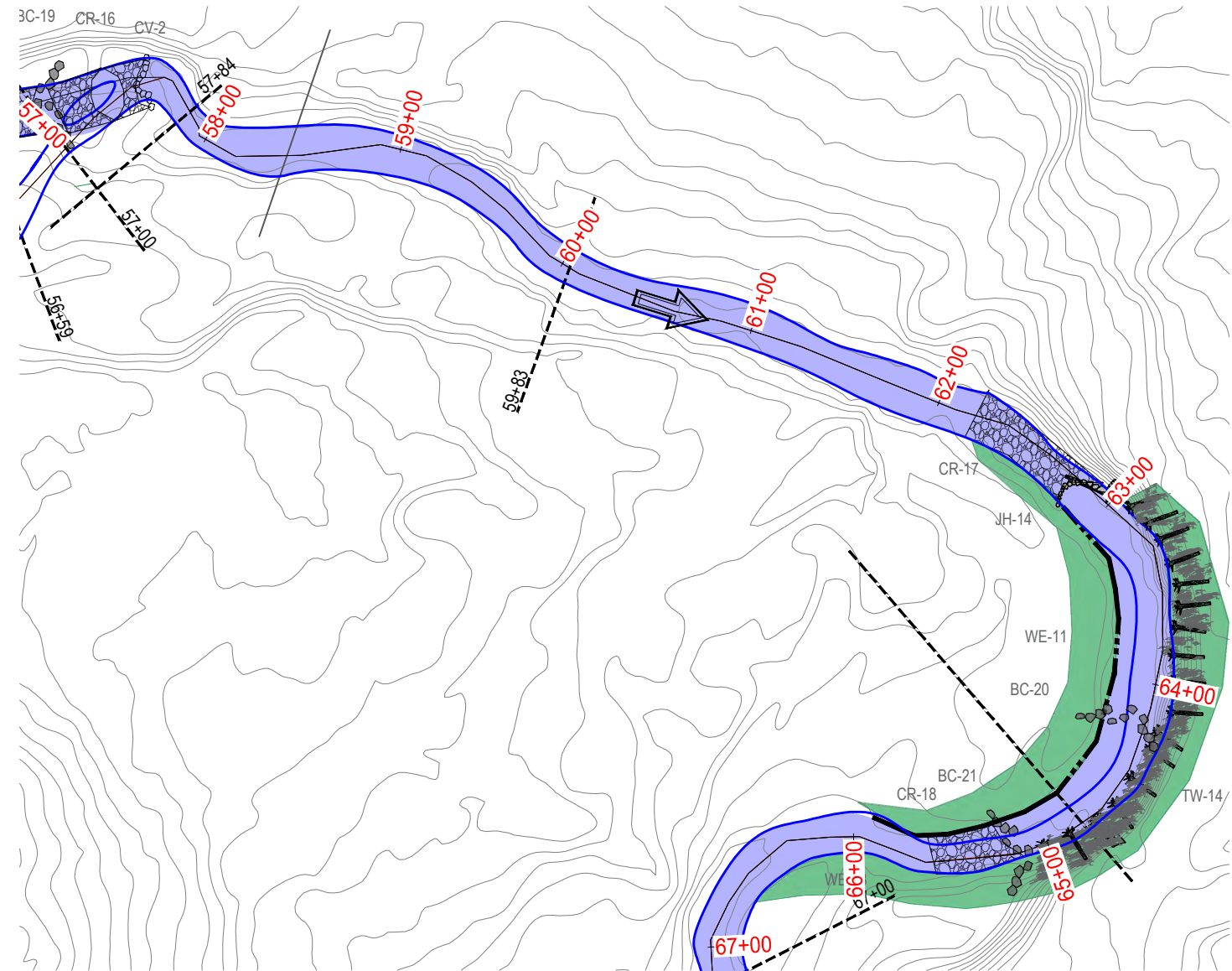


#	DATE	DESCRIPTION

DATE | JANUARY 2020
 DRAWN | MGS/COD
 DESIGNED | ACS
 CHECKED |
 PROJECT # | J188372100
 SHEET TITLE
 AREA 10
 SHEET NUMBER
 24
 LAND USE #

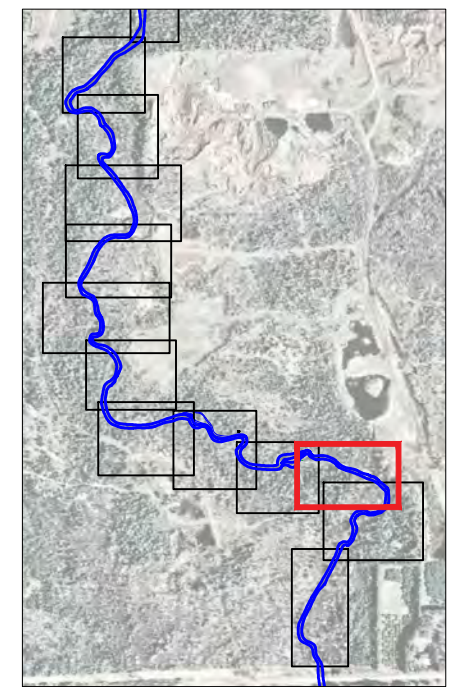
60% DESIGN

R:\Projects\18188372100_Env\TroubleShooting\Area10\Drawings\20200117_Land_Use.dwg - 10:02:03.99 AM



NOTE:
1. Final position, orientation, and elevation of large wood additions to be determined in the field by on-site construction supervisor.

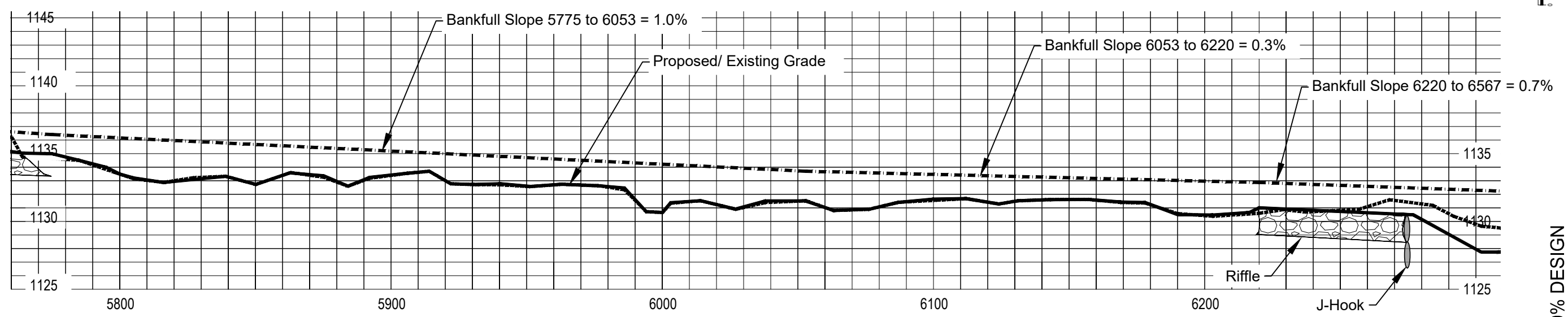
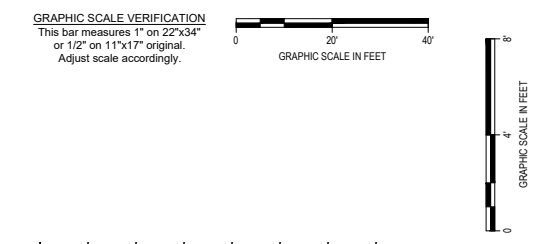
- LEGEND**
- EDGE OF WATER
 - EXISTING GRADE
 - DRAINAGE FLOW
 - TOEWOOD
 - J-HOOK
 - BOULDER CLUSTER
 - CROSS VANE
 - BANK GRADING
 - CHANNEL RE-ROUTE
 - SUBGRADE LOG VANE
 - LOG ROLLER
 - CHANNEL TO BE FILLED
 - CONSTRUCTED RIFFLE
 - LARGE WOOD HABITAT ENHANCEMENT



KEY MAP
GRAPHIC SCALE VERIFICATION
This bar measures 1" on 22"x34"
or 1/2" on 11"x17" original.
Adjust scale accordingly.

0 600 1200
GRAPHIC SCALE IN FEET

PROFILE 57+50 TO 63+00



AREA 10 PROPOSED PLAN

**KNIFE RIVER
ENVIRONMENTAL TROUBLE SHOOTERS
LAKE COUNTY, MINNESOTA**

DATE	DESCRIPTION

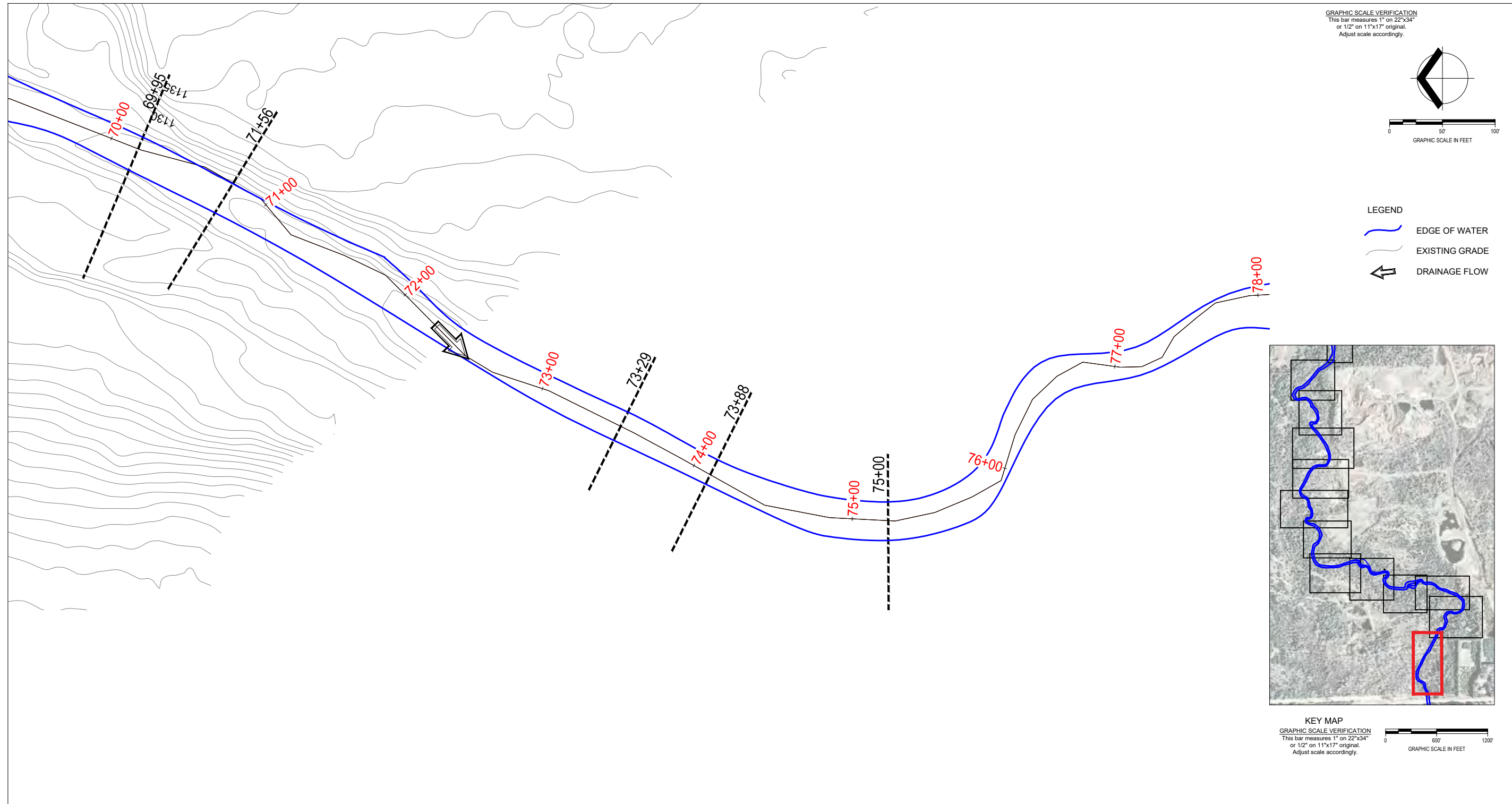
DATE	JANUARY 2020
DRAWN	MGSC/CD
DESIGNED	JACS
CHECKED	I
PROJECT #	J188372100

SHEET TITLE	AREA 10
SHEET NUMBER	25
LAND USE #	

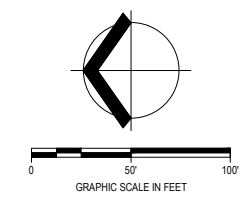
Cardno
MADISON
640 COTTONWOOD DRIVE, SUITE A
FITCHBURG, WISCONSIN 53719
TEL: (608) 861-2365 FAX: (608) 861-2361
www.cardnoinc.com

R:\Project\1818372100_Env\TroubleShooters_KnifeRiver\Area10\CD\Area10_Plan_Sheet.dwg - 1/13/2020 1:58:28 PM

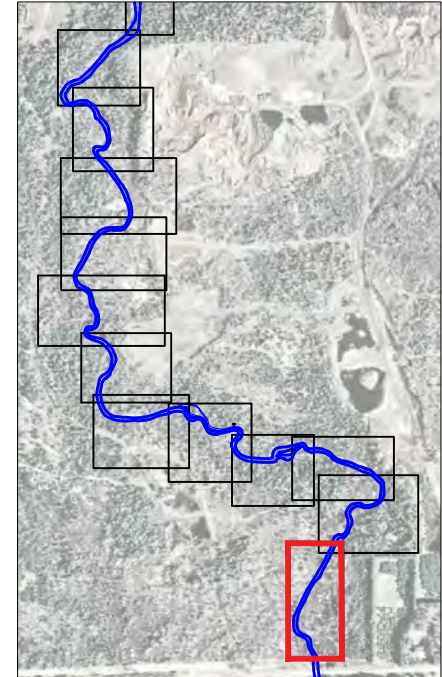
60% DESIGN



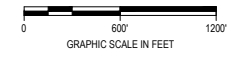
GRAPHIC SCALE VERIFICATION
 This bar measures 1" on 22"x34"
 or 1/2" on 11"x17" original.
 Adjust scale accordingly.



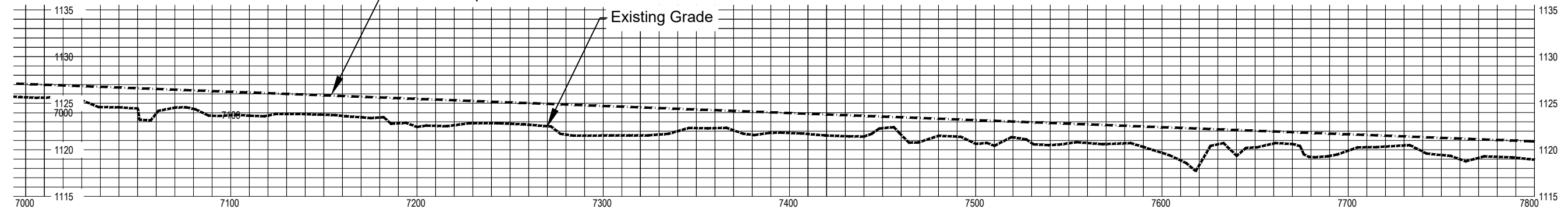
- LEGEND
- EDGE OF WATER
 - EXISTING GRADE
 - DRAINAGE FLOW



KEY MAP
 GRAPHIC SCALE VERIFICATION
 This bar measures 1" on 22"x34"
 or 1/2" on 11"x17" original.
 Adjust scale accordingly.



PROFILE 70+00 TO 78+00



60% DESIGN

REFERENCE REACH 70+00 TO 74+00
KNIFE RIVER
ENVIRONMENTAL TROUBLE SHOOTERS
LAKE COUNTY, MINNESOTA

#	DATE	DESCRIPTION

DATE	JANUARY 2020
DRAWN	JMGS/COD
DESIGNED	JACS
CHECKED	I
PROJECT #	J188372100

SHEET TITLE
REF 70+00 TO 74+00
 SHEET NUMBER

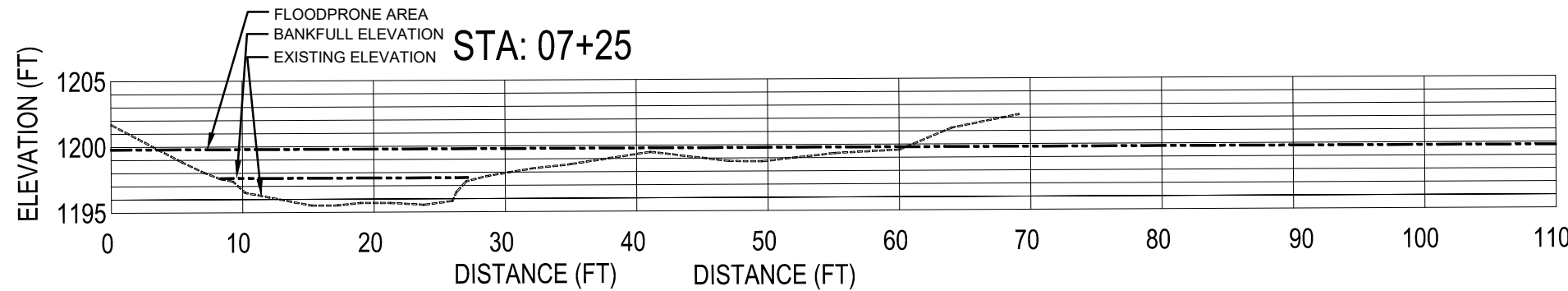
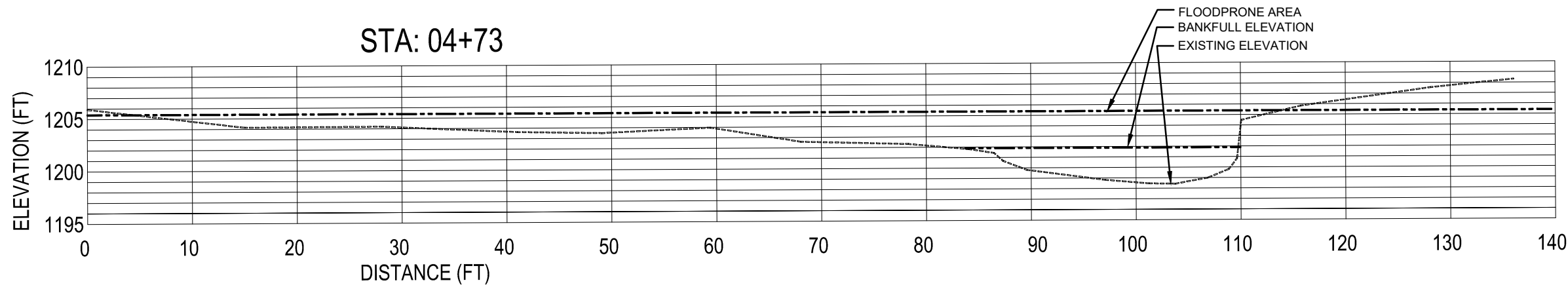
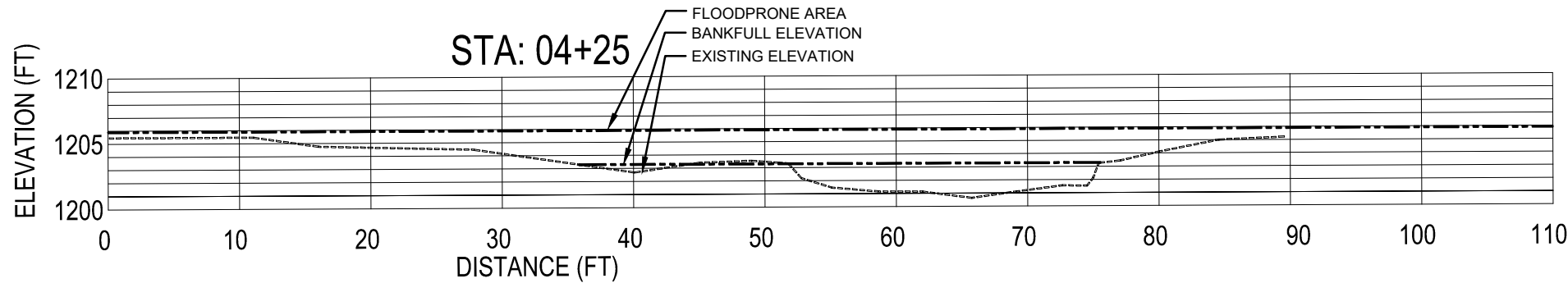
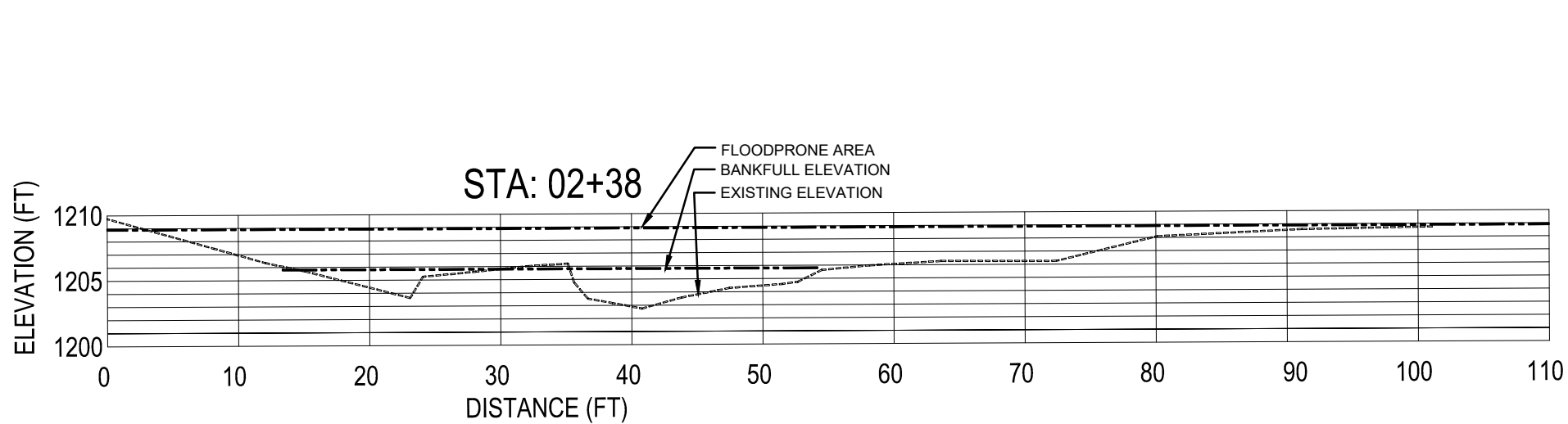
28

LAND USE #

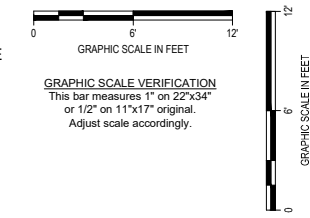
Cardno
 MADISON
 640 COTTONWOOD DRIVE, SUITE A
 FITCHBURG, WISCONSIN 53719
 TEL: (608) 861-2365 FAX: (608) 861-2361
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R:\Project\18188372100_Env\TroubleShooters_KnifeRiver\Task\2020\01_Land_Use_Sheet.dwg - 10/20/20 1:15:11 PM

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LEGEND
 --- EXISTING GRADE



EXISTING CROSS SECTIONS
KNIFE RIVER
ENVIRONMENTAL TROUBLE SHOOTERS
LAKE COUNTY, MINNESOTA

#	DATE	DESCRIPTION

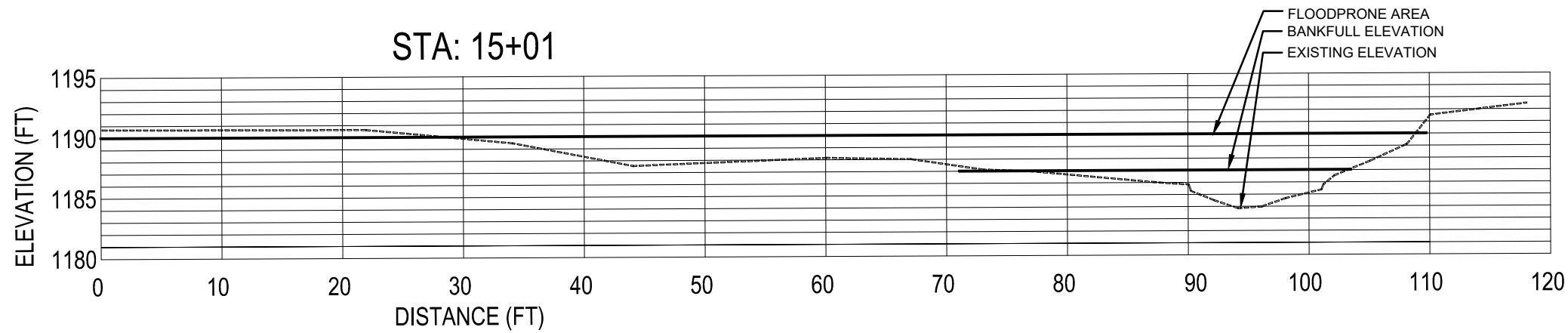
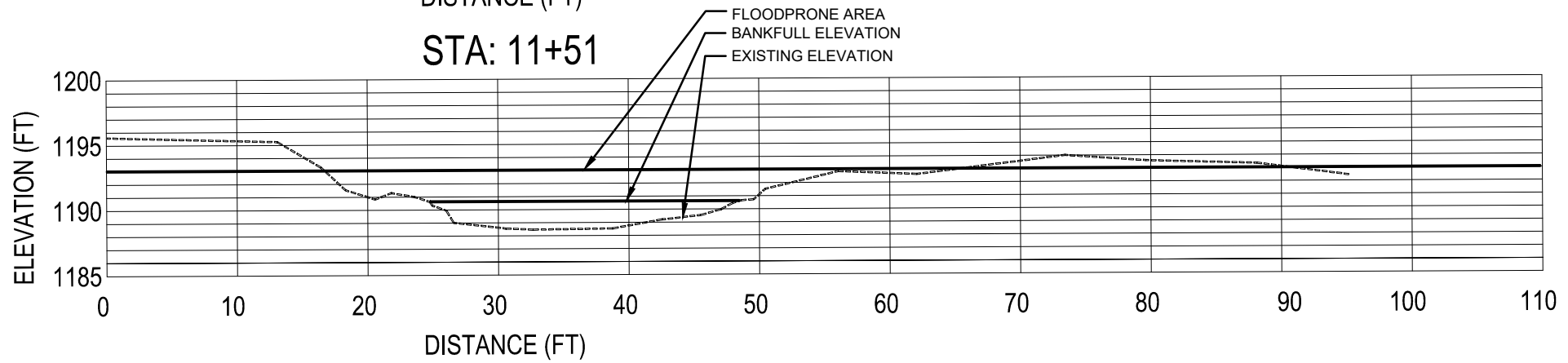
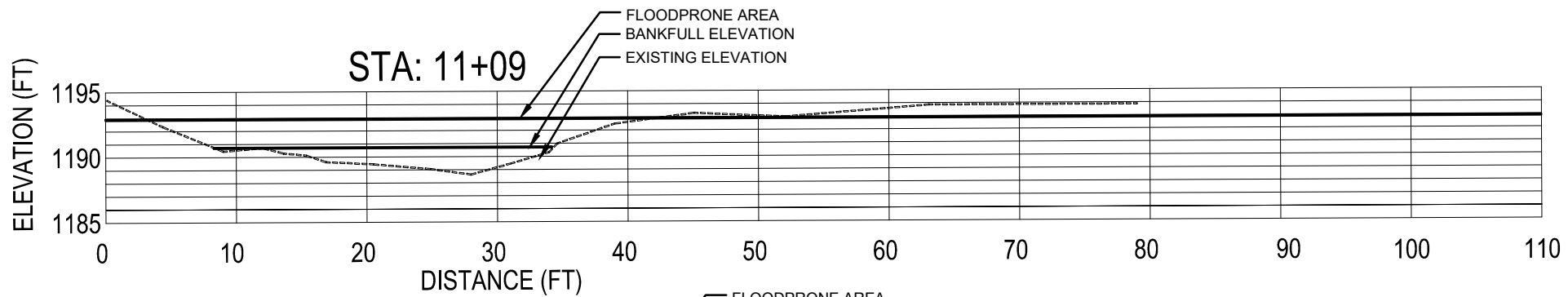
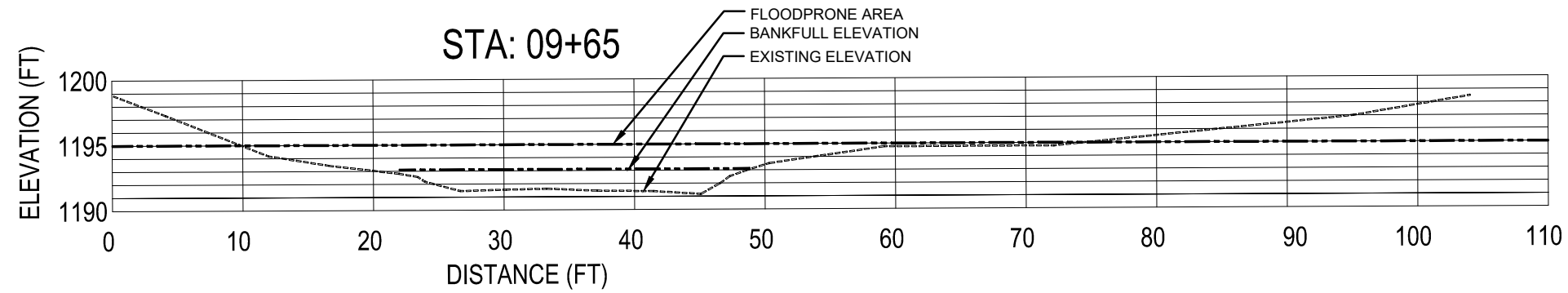
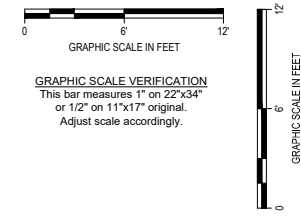
60% DESIGN

DATE	JANUARY 2020
DRAWN	JMGS/COD
DESIGNED	JACS
CHECKED	I
PROJECT #	J188372100

SHEET TITLE
CROSS SECTIONS
 SHEET NUMBER
29
 LAND USE #

LEGEND

--- EXISTING GRADE

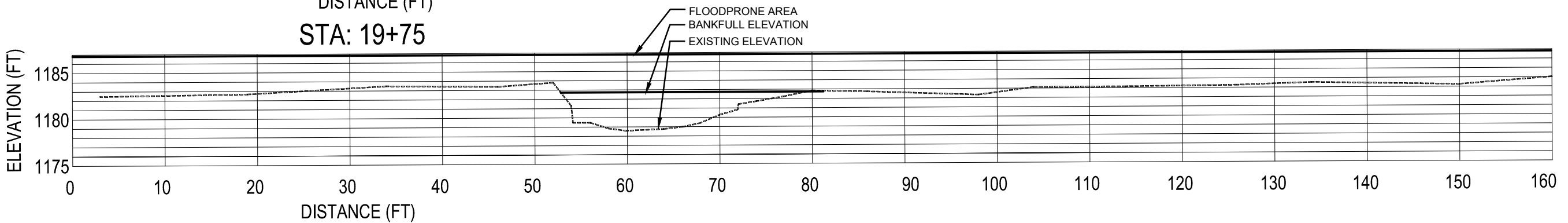
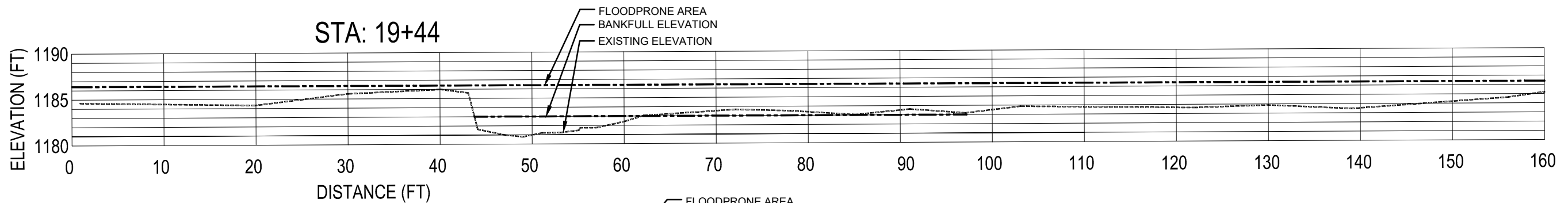
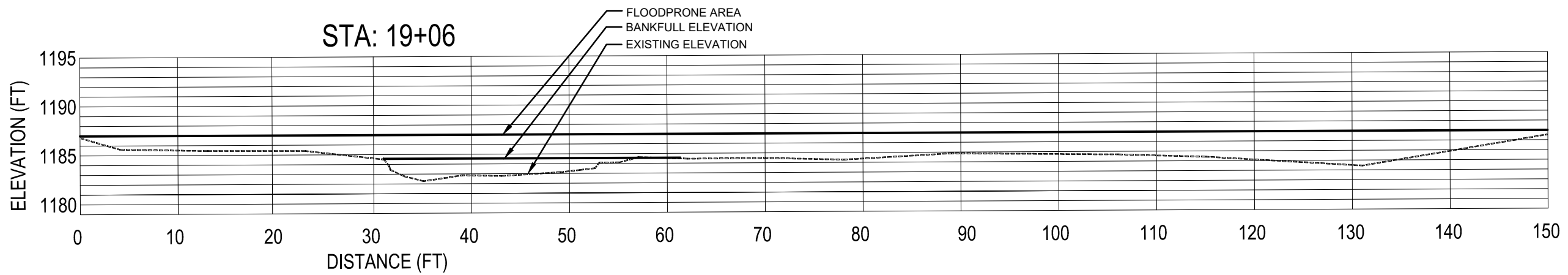
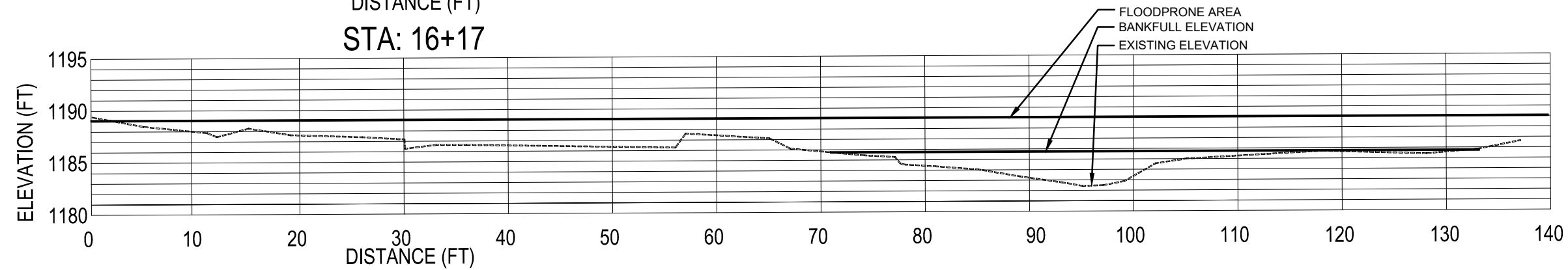
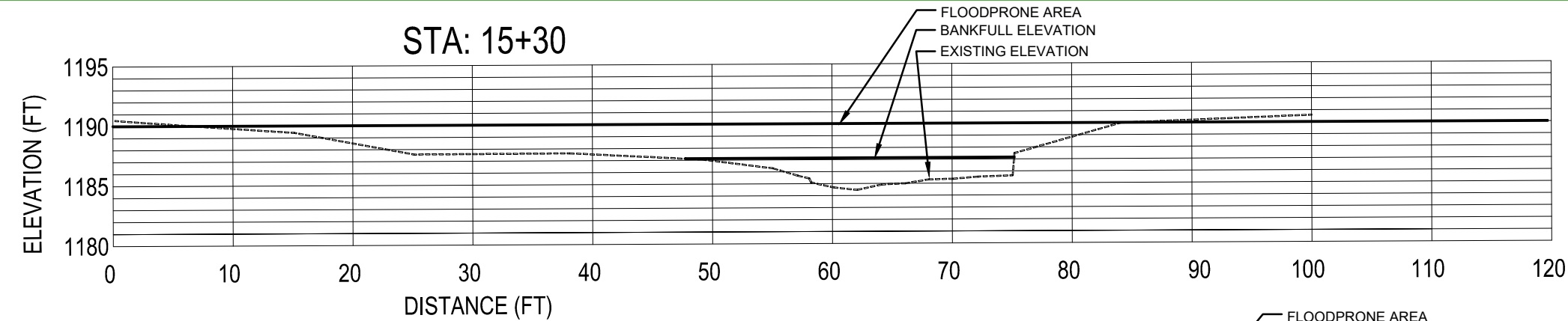


EXISTING CROSS SECTIONS
KNIFE RIVER
ENVIRONMENTAL TROUBLE SHOOTERS
LAKE COUNTY, MINNESOTA

#	DATE	DESCRIPTION

60% DESIGN

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#	DATE	DESCRIPTION

DATE	JANUARY 2020
DRAWN	JMGS/COD
DESIGNED	JACS
CHECKED	I
PROJECT #	J188372100

SHEET TITLE
CROSS SECTIONS
SHEET NUMBER

31

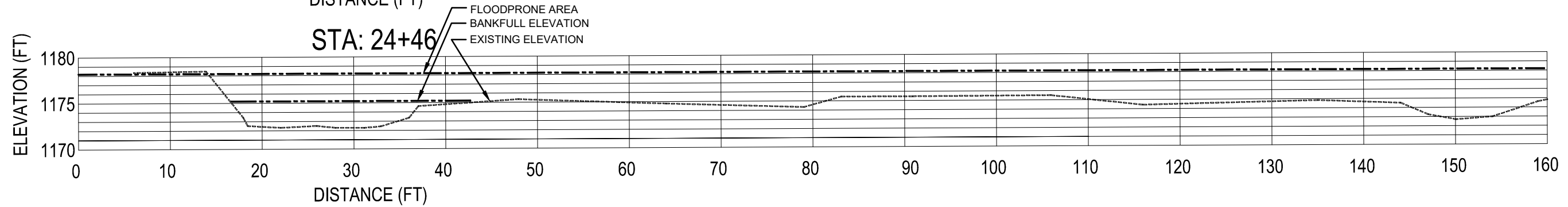
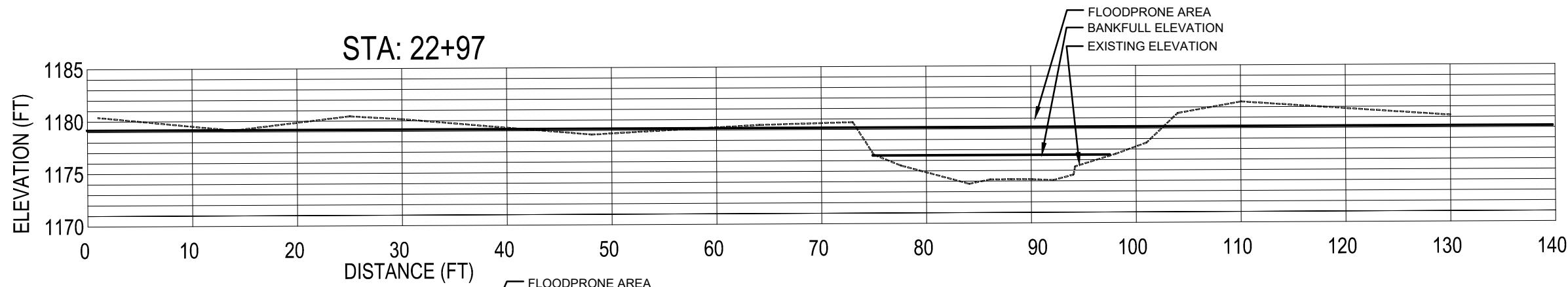
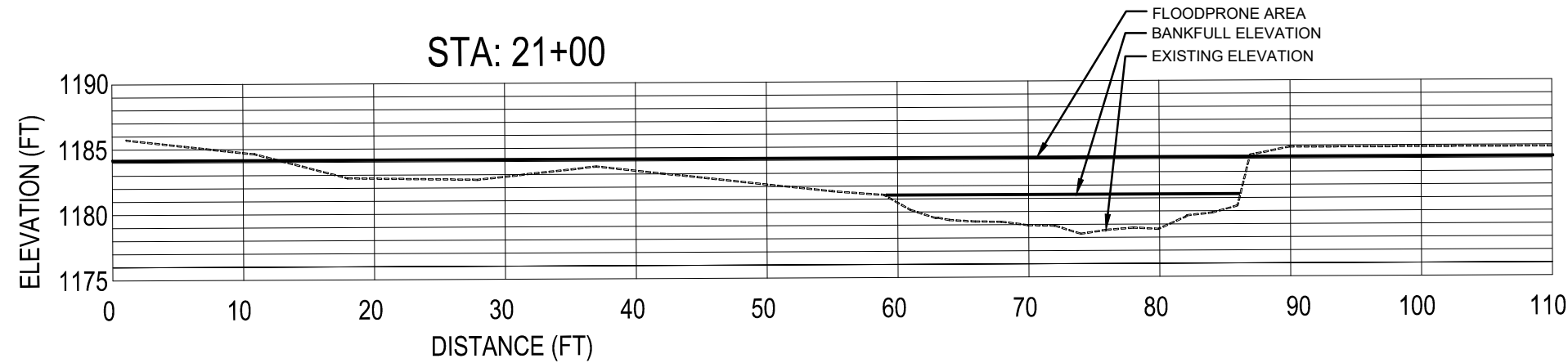
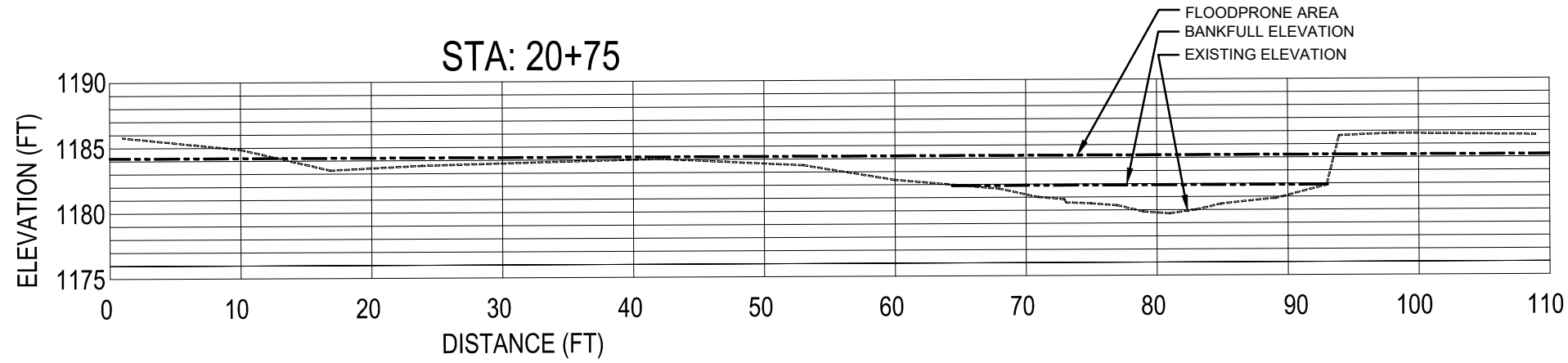
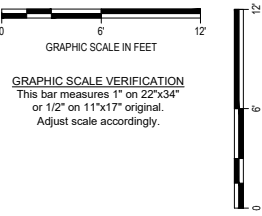
LAND USE #

R:\Project\18188372100_Env\TroubleShooters_KnifeRiver\CrossSections\2020\01_Layer_31.dwg - 10/20/20 1:59:42 PM

60% DESIGN

LEGEND

--- EXISTING GRADE



EXISTING CROSS SECTIONS
KNIFE RIVER
ENVIRONMENTAL TROUBLE SHOOTERS
LAKE COUNTY, MINNESOTA

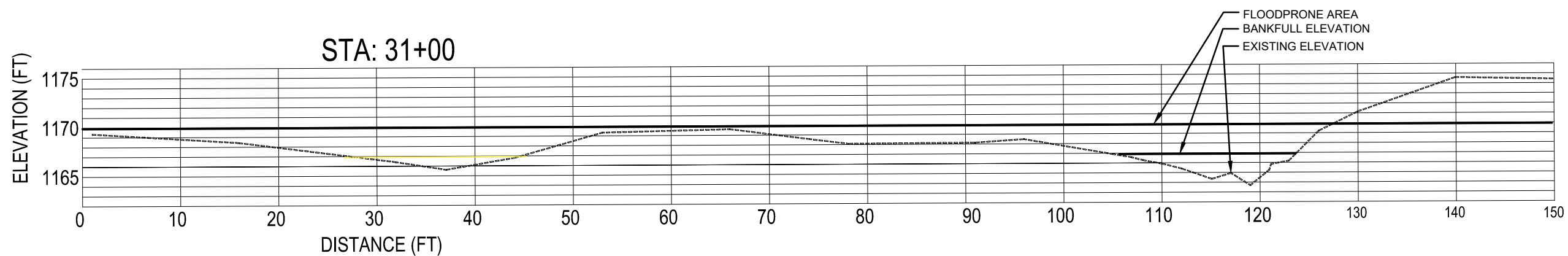
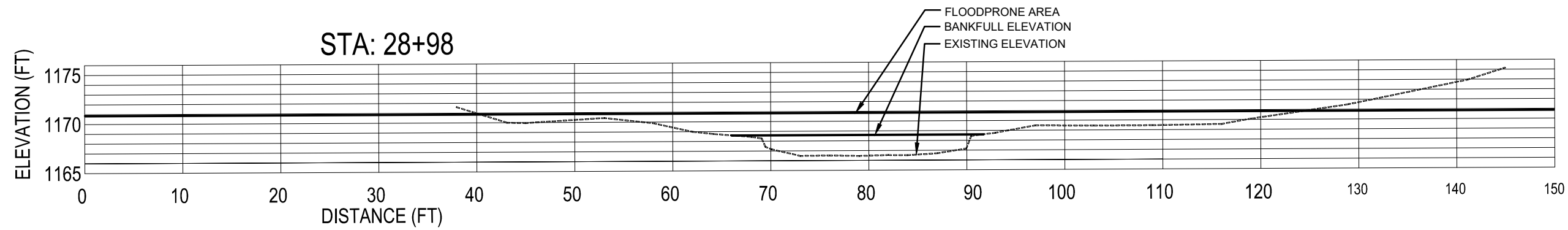
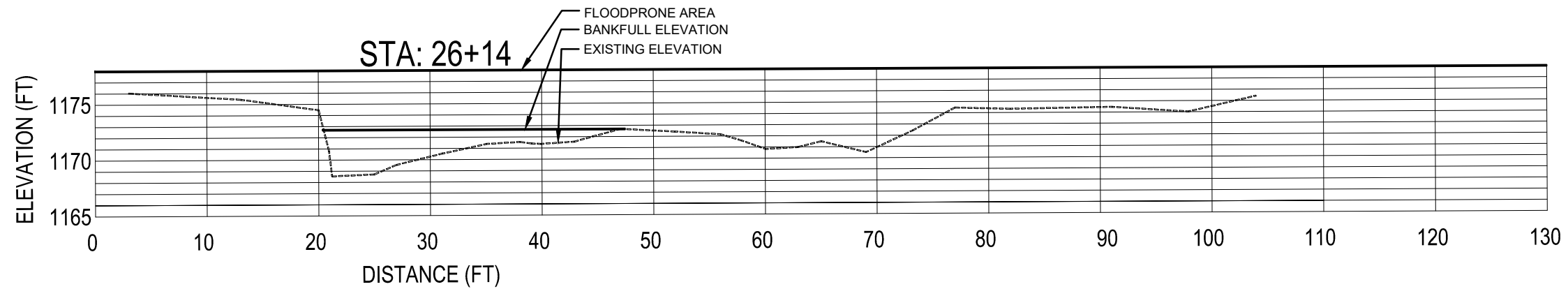
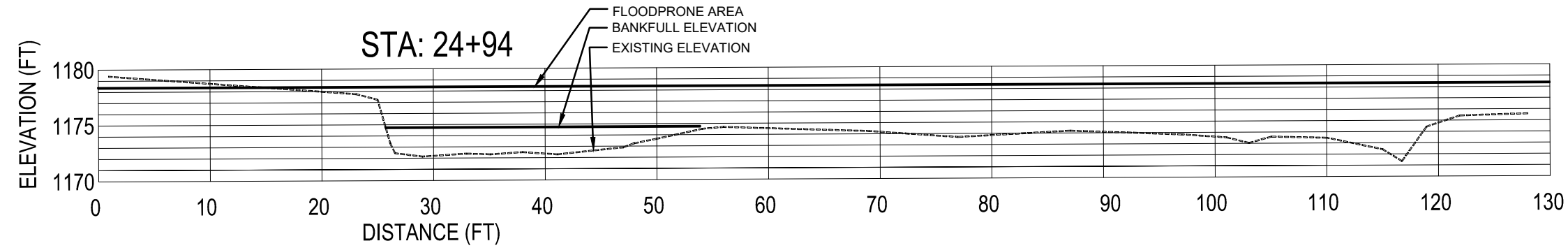
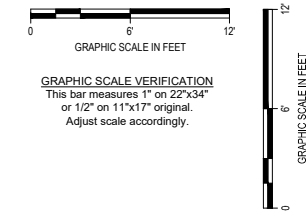
#	DATE	DESCRIPTION

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60% DESIGN

LEGEND

--- EXISTING GRADE



R:\Project\181883720_Env\Drawings\CD\Drawings\2020\07_Layer_Sheets.dwg - 1/15/2021 1:08:03 PM



EXISTING CROSS SECTIONS
KNIFE RIVER
ENVIRONMENTAL TROUBLE SHOOTERS
LAKE COUNTY, MINNESOTA

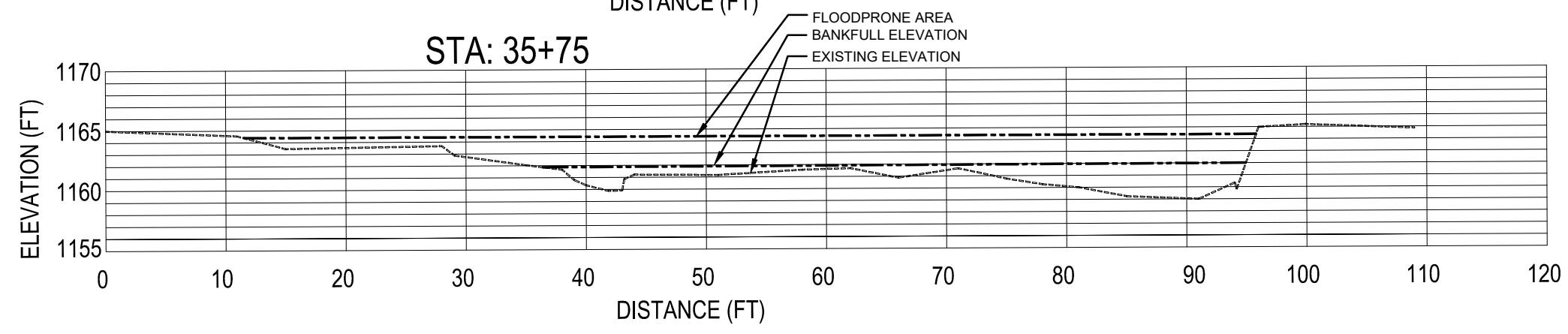
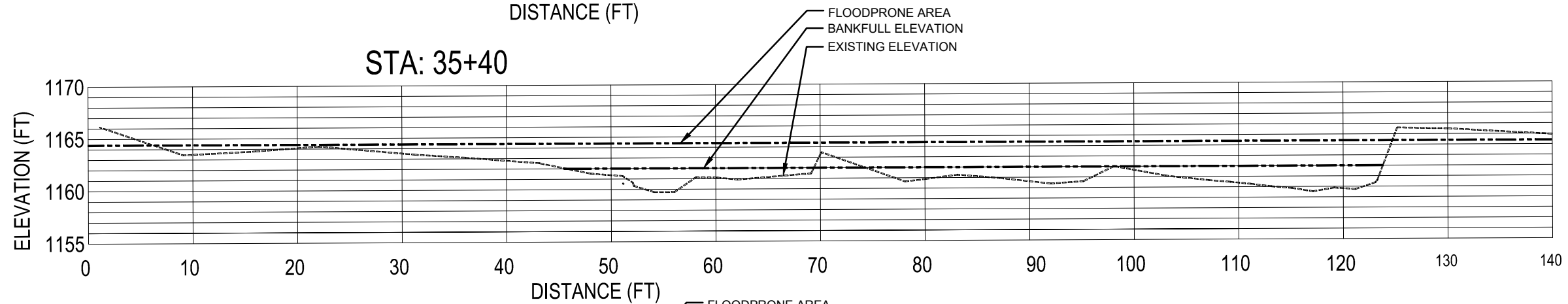
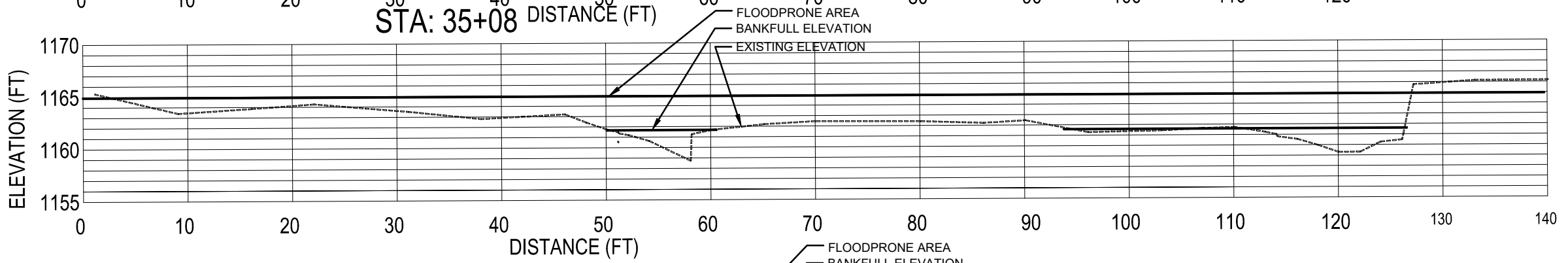
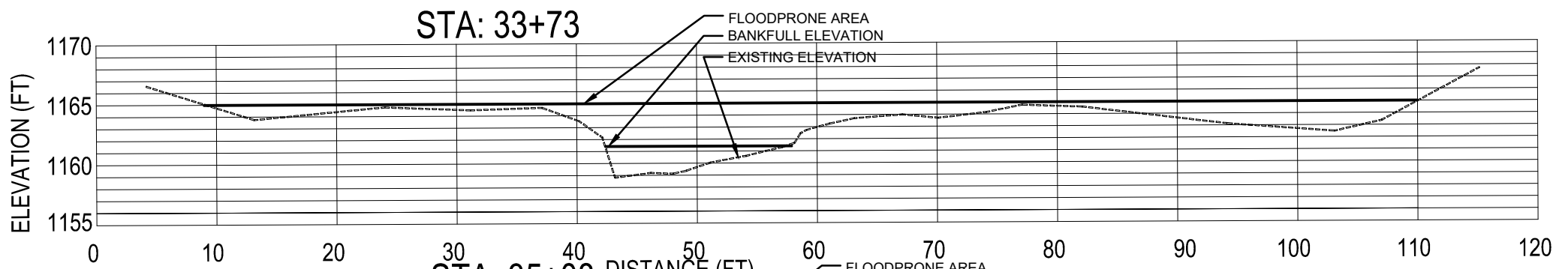
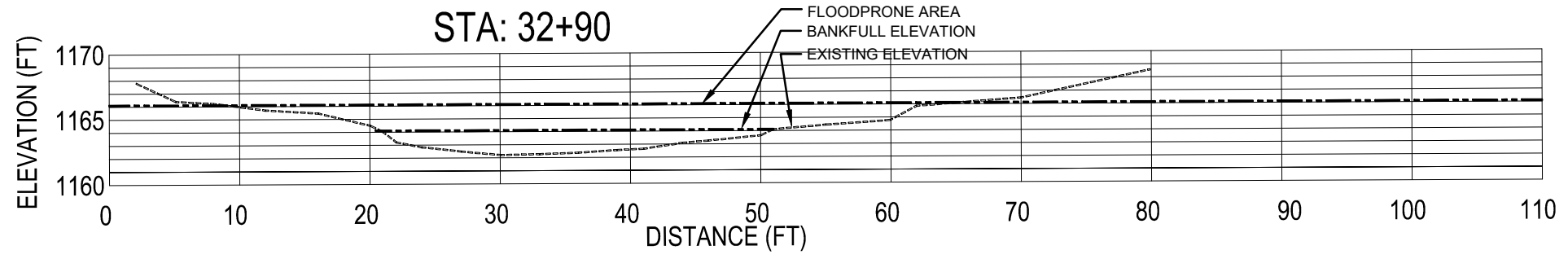
#	DATE	DESCRIPTION

DATE | JANUARY 2020
DRAWN | MGS/COD
DESIGNED | ACS
CHECKED | I
PROJECT # | J188372100

SHEET TITLE
CROSS SECTIONS
SHEET NUMBER

33
LAND USE #

60% DESIGN



LEGEND

--- EXISTING GRADE

GRAPHIC SCALE IN FEET
This bar measures 1" on 22"x34" or 1/2" on 11"x17" original. Adjust scale accordingly.

GRAPHIC SCALE IN FEET

Cardno
MADISON
640 COTTONWOOD DRIVE, SUITE A
FITCHBURG, WISCONSIN 53719
TEL: (609) 861-2865 FAX: (609) 861-2867
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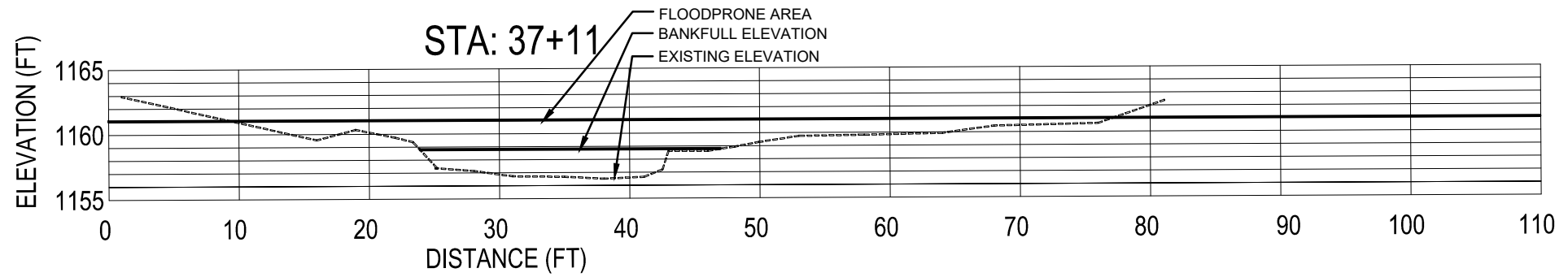
EXISTING CROSS SECTIONS
KNIFE RIVER
ENVIRONMENTAL TROUBLE SHOOTERS
LAKE COUNTY, MINNESOTA

#	DATE	DESCRIPTION

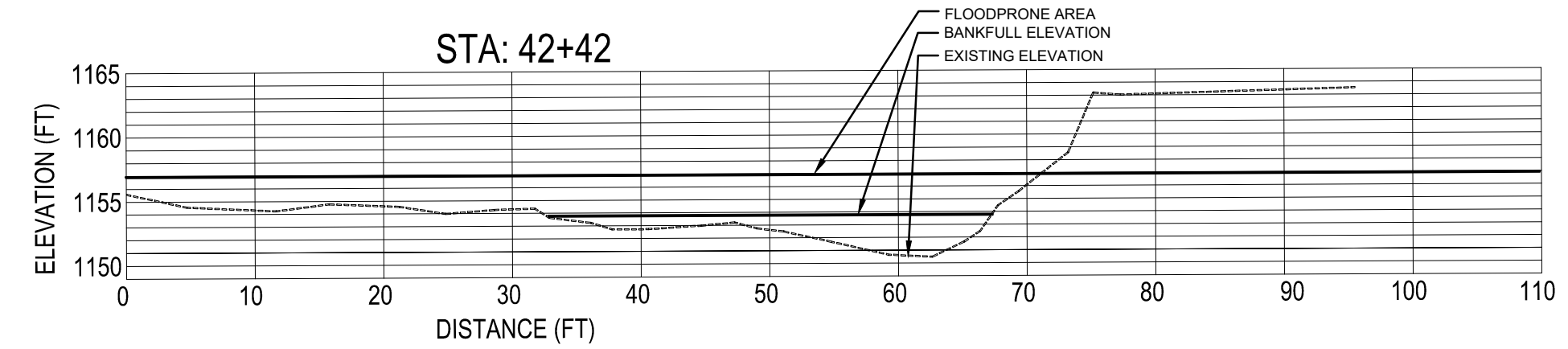
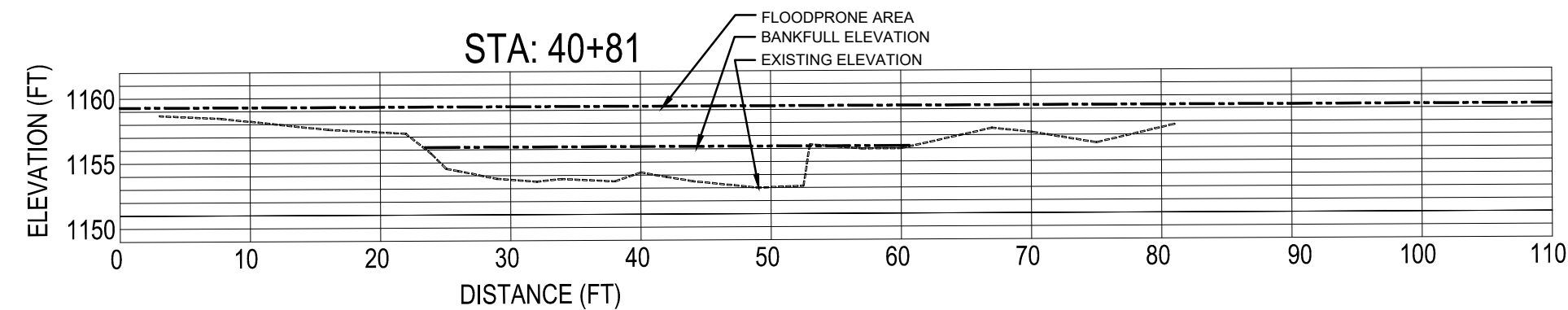
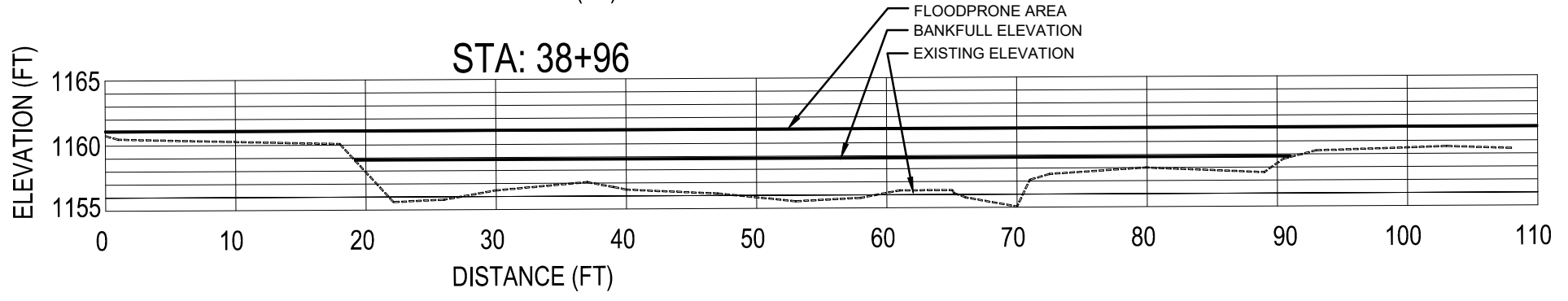
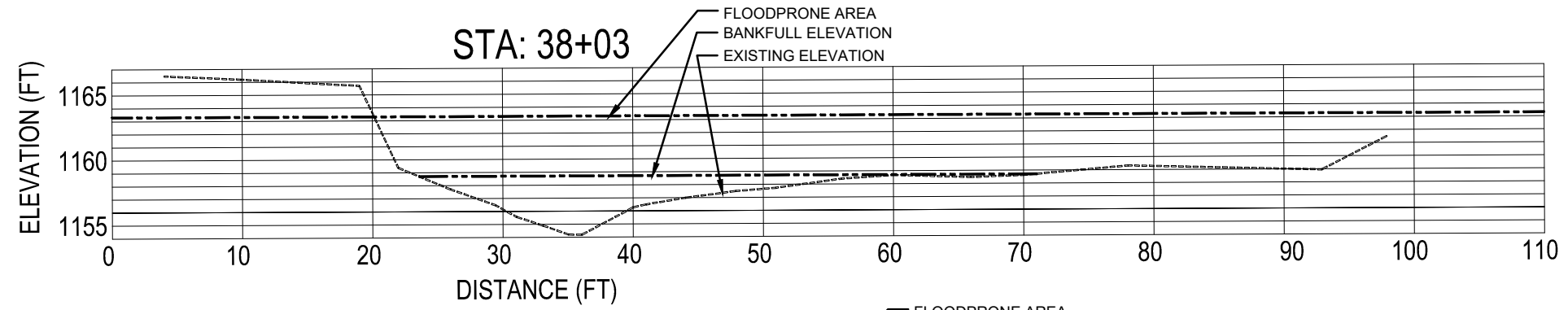
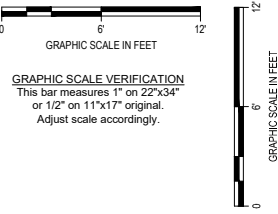
60% DESIGN

DATE	JANUARY 2020
DRAWN	JMGS/COD
DESIGNED	JACS
CHECKED	I
PROJECT #	J188372100
SHEET TITLE	CROSS SECTIONS
SHEET NUMBER	34
LAND USE #	

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LEGEND
----- EXISTING GRADE



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EXISTING CROSS SECTIONS
KNIFE RIVER
ENVIRONMENTAL TROUBLE SHOOTERS
LAKE COUNTY, MINNESOTA

#	DATE	DESCRIPTION

DATE | JANUARY 2020
DRAWN | MGS/COD
DESIGNED | ACS
CHECKED | I
PROJECT # | J188372100

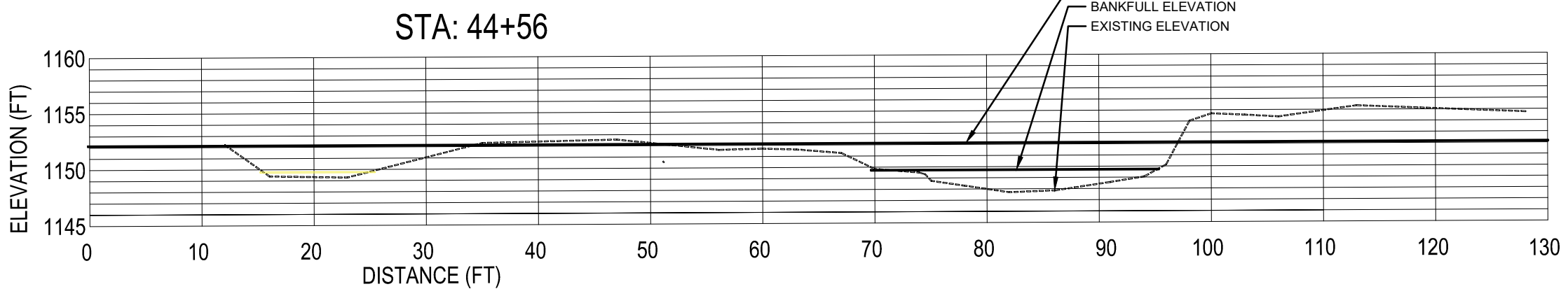
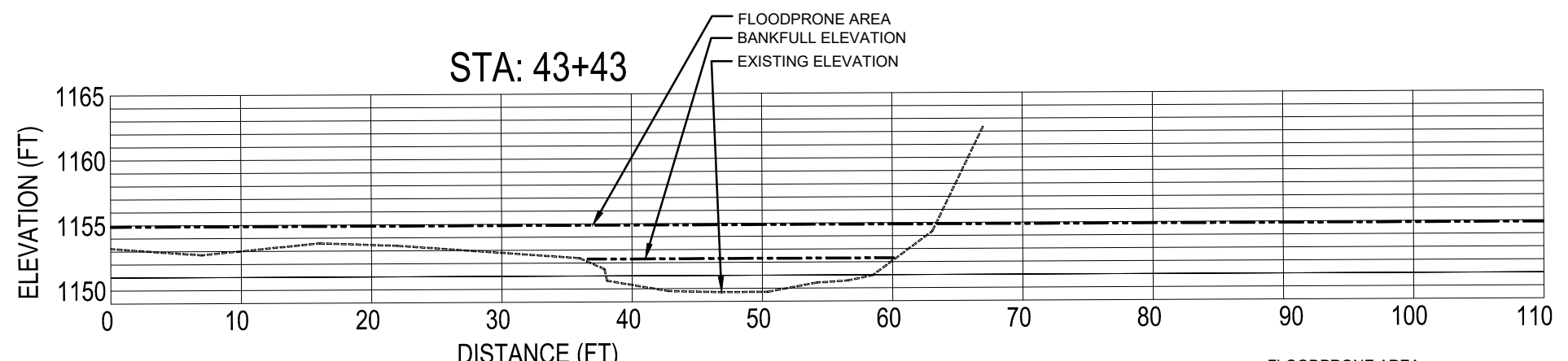
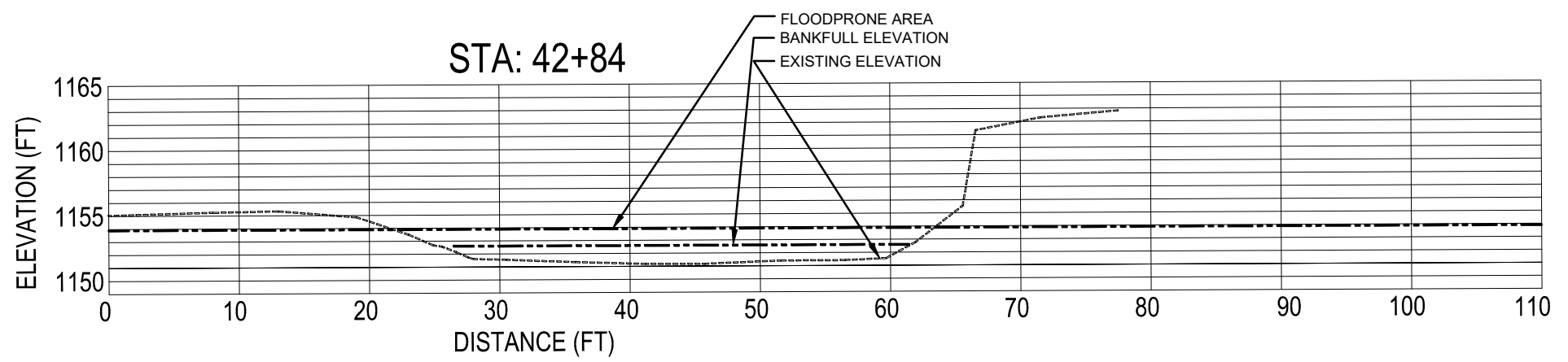
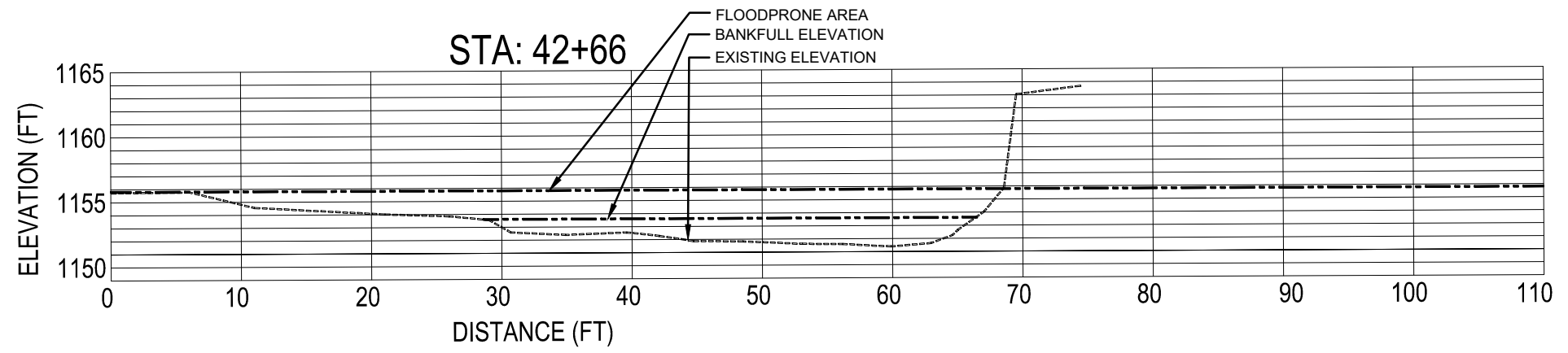
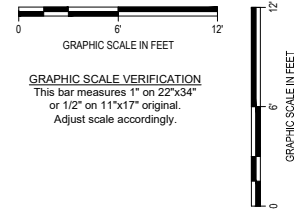
SHEET TITLE
CROSS SECTIONS
SHEET NUMBER

35

LAND USE #

60% DESIGN

LEGEND
 - - - - - EXISTING GRADE



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EXISTING CROSS SECTIONS

#	DATE	DESCRIPTION

KNIFE RIVER

ENVIRONMENTAL TROUBLE SHOOTERS
 LAKE COUNTY, MINNESOTA



MADISON
 6140 COTTONWOOD DRIVE, SUITE A
 FITCHBURG, WISCONSIN 53719
 TEL: (608) 661-2365 FAX: (608) 661-2367
 www.cardno.com

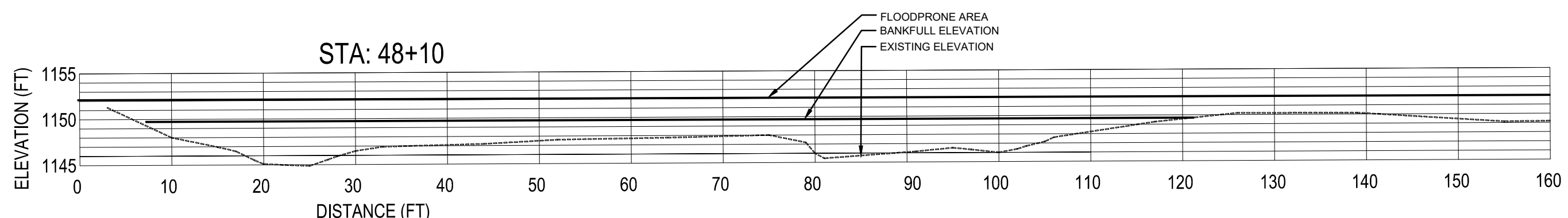
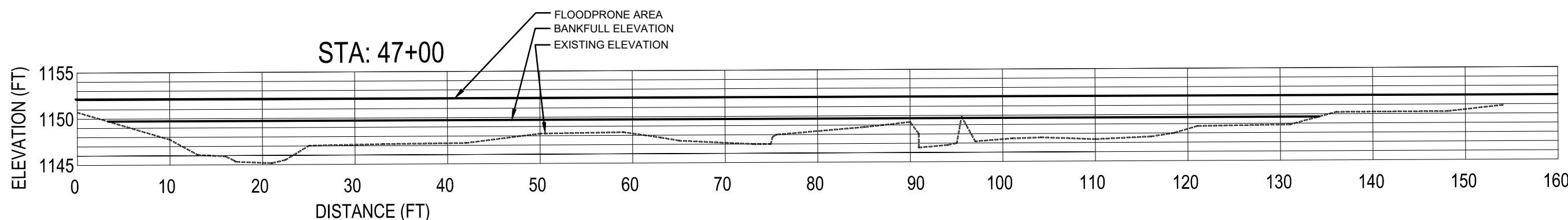
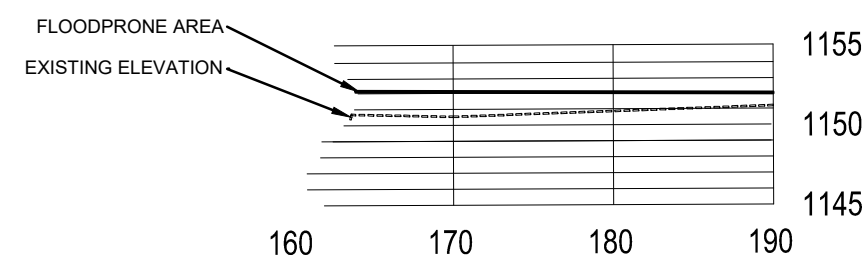
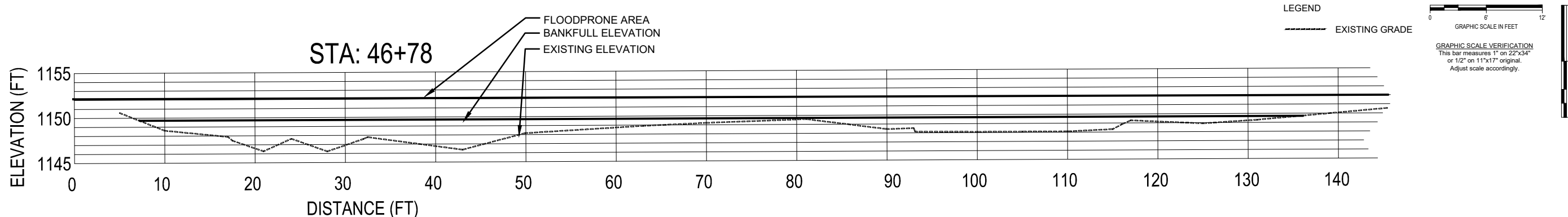
DATE	JANUARY 2020
DRAWN	JMGS/COO
DESIGNED	JACS
CHECKED	I
PROJECT #	J188372100

SHEET TITLE
 CROSS SECTIONS

SHEET NUMBER
 32

LAND USE #

60% DESIGN



EXISTING CROSS SECTIONS
KNIFE RIVER
ENVIRONMENTAL TROUBLE SHOOTERS
LAKE COUNTY, MINNESOTA

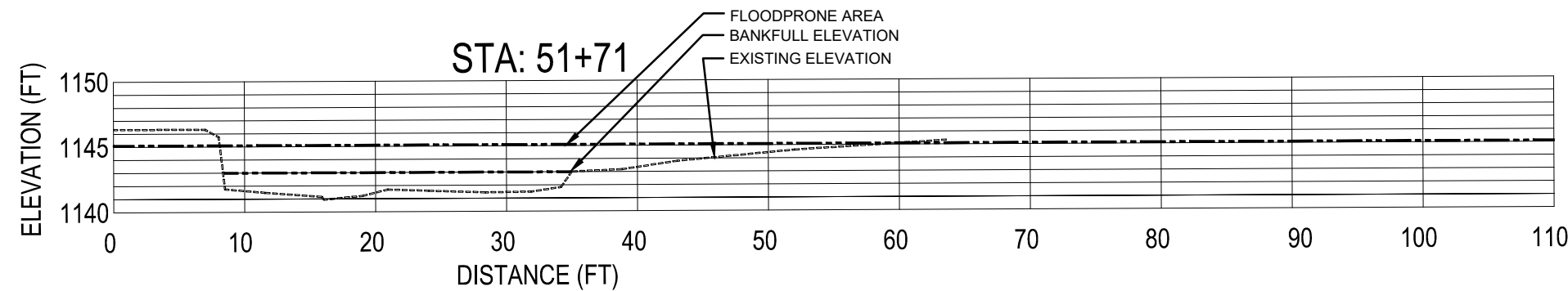
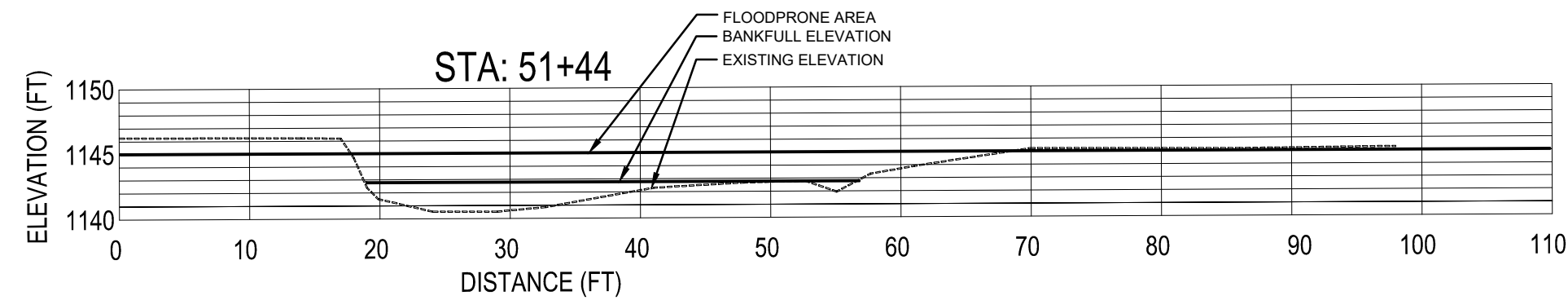
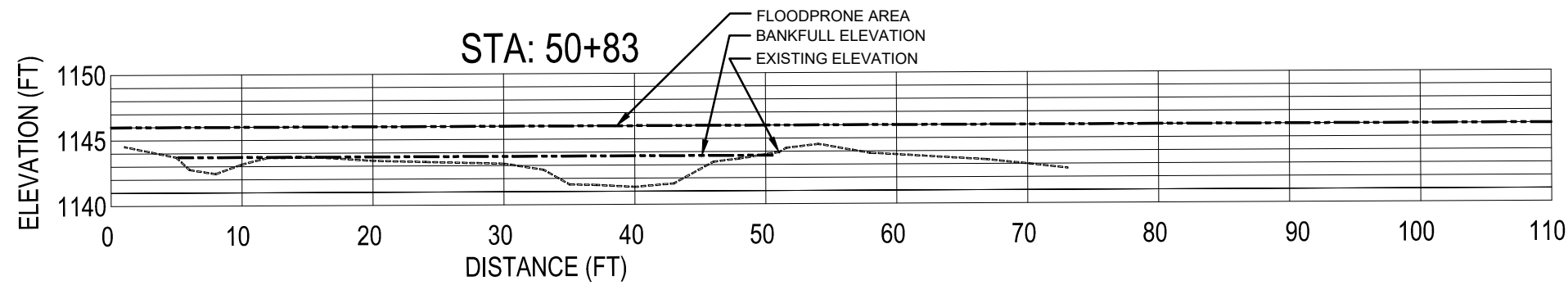
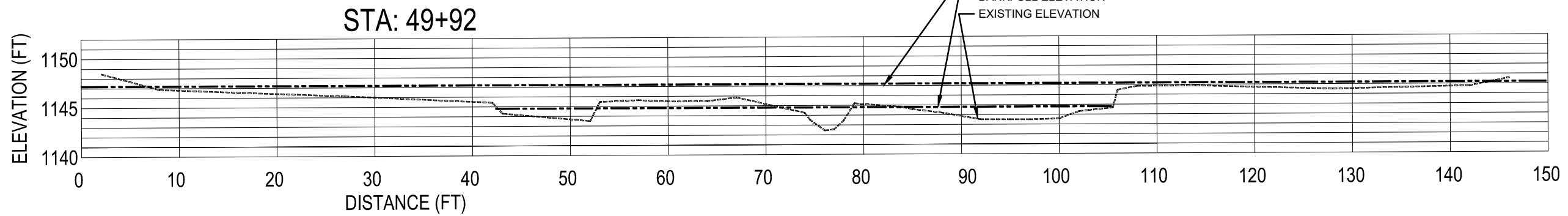
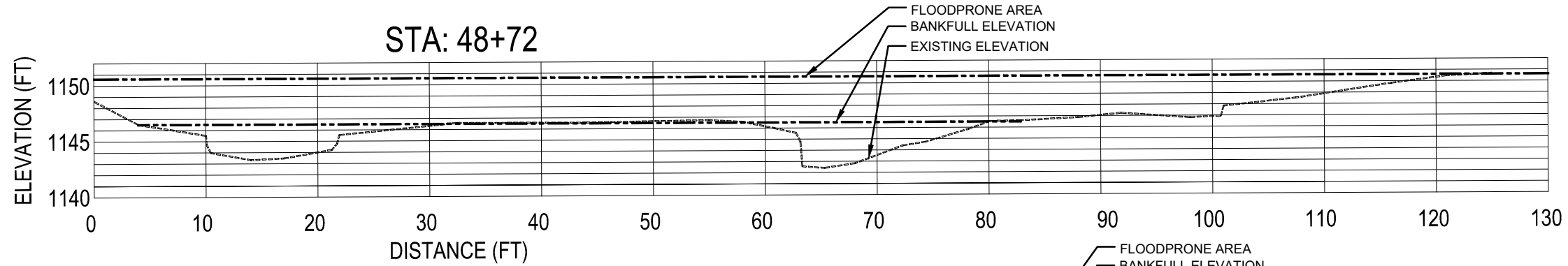
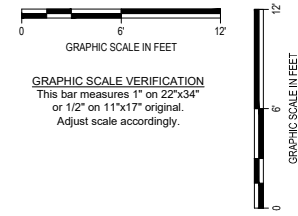
#	DATE	DESCRIPTION

60% DESIGN

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LEGEND

--- EXISTING GRADE



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EXISTING CROSS SECTIONS
KNIFE RIVER
ENVIRONMENTAL TROUBLE SHOOTERS
LAKE COUNTY, MINNESOTA

#	DATE	DESCRIPTION

DATE	JANUARY 2020
DRAWN	JMGS/COD
DESIGNED	JACS
CHECKED	I
PROJECT #	J188372100

SHEET TITLE
CROSS SECTIONS
 SHEET NUMBER

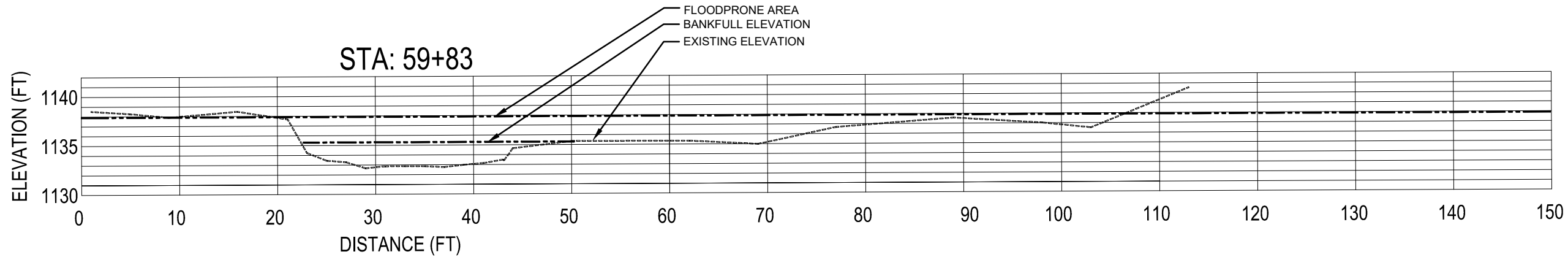
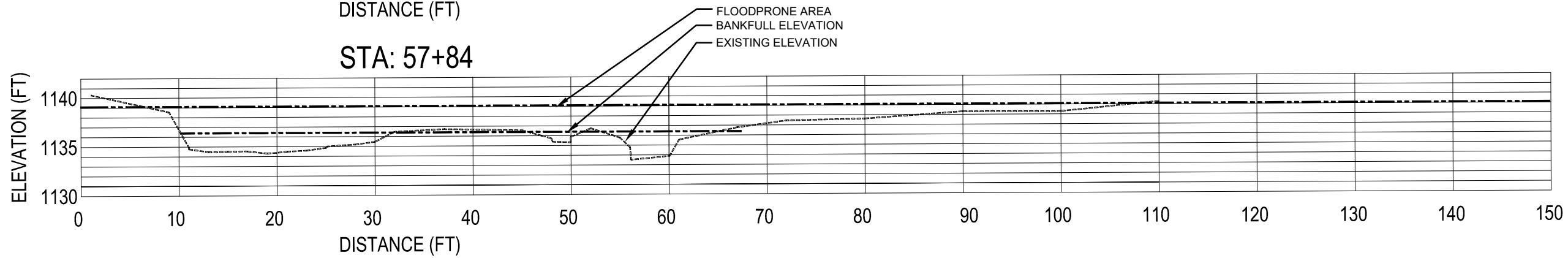
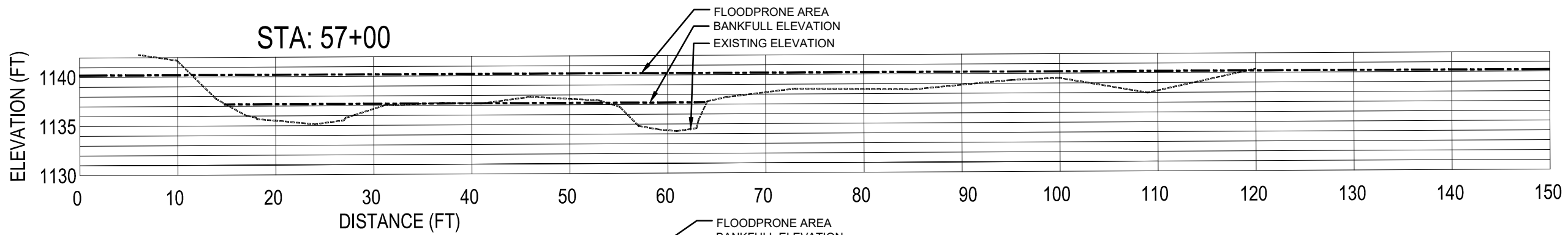
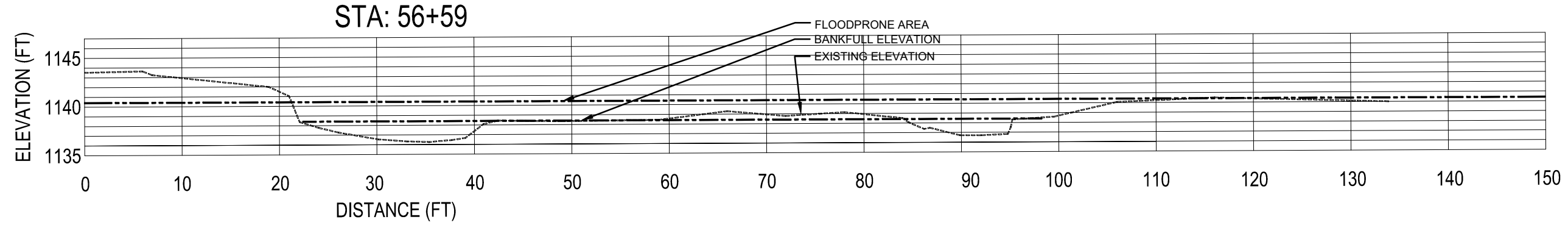
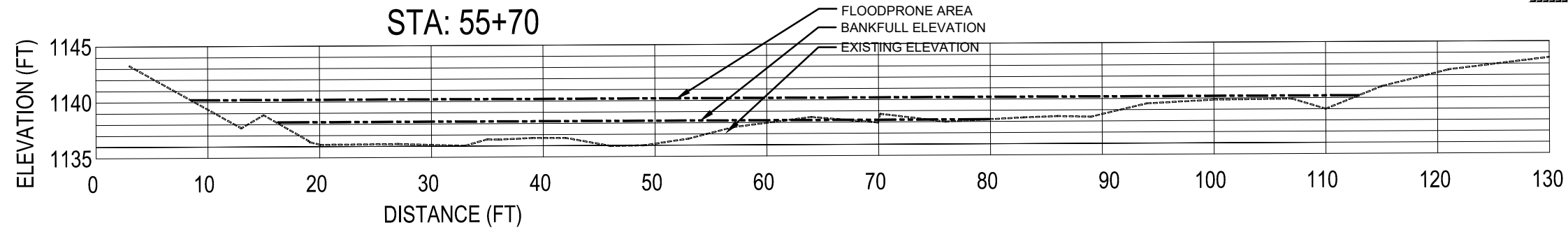
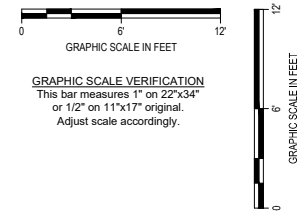
38

LAND USE #

60% DESIGN

LEGEND

--- EXISTING GRADE



EXISTING CROSS SECTIONS
KNIFE RIVER
ENVIRONMENTAL TROUBLE SHOOTERS
LAKE COUNTY, MINNESOTA

#	DATE	DESCRIPTION

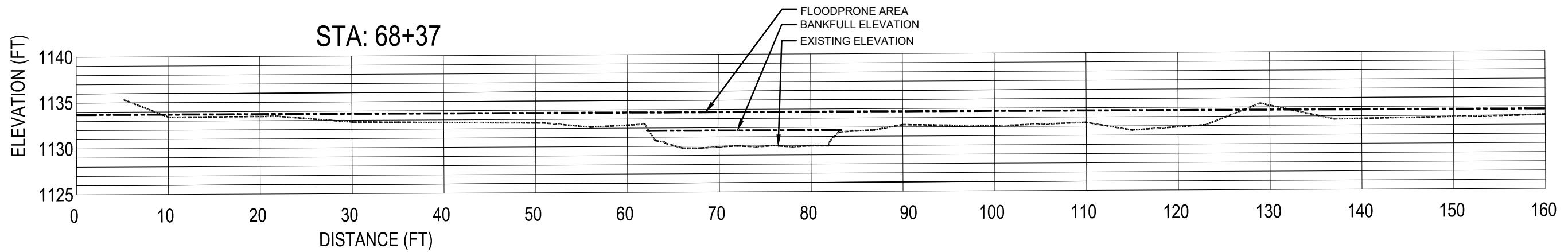
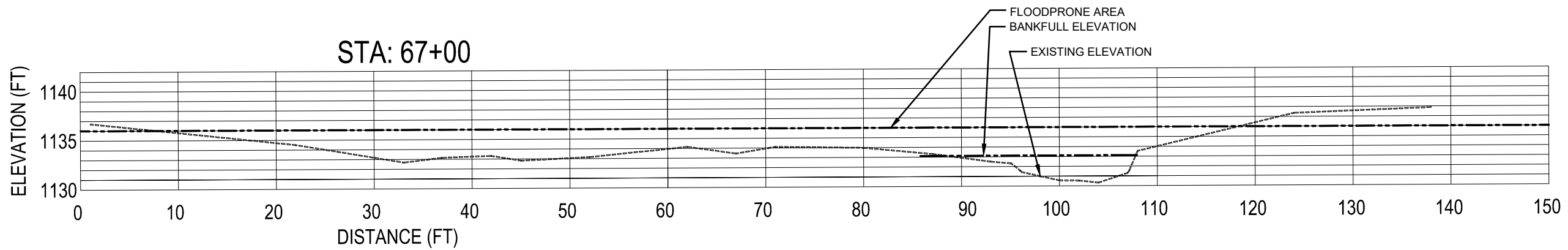
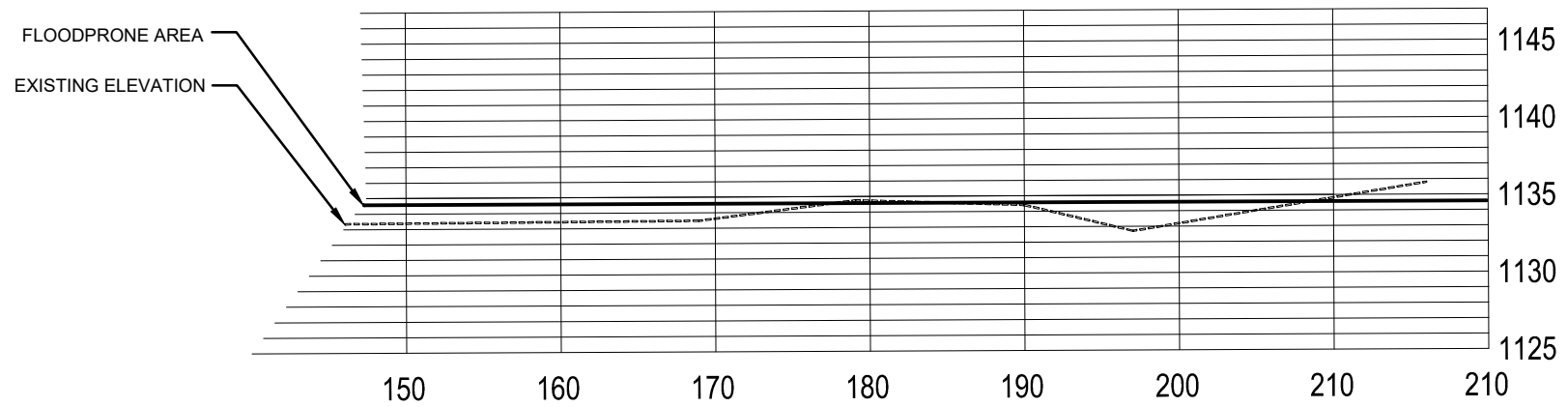
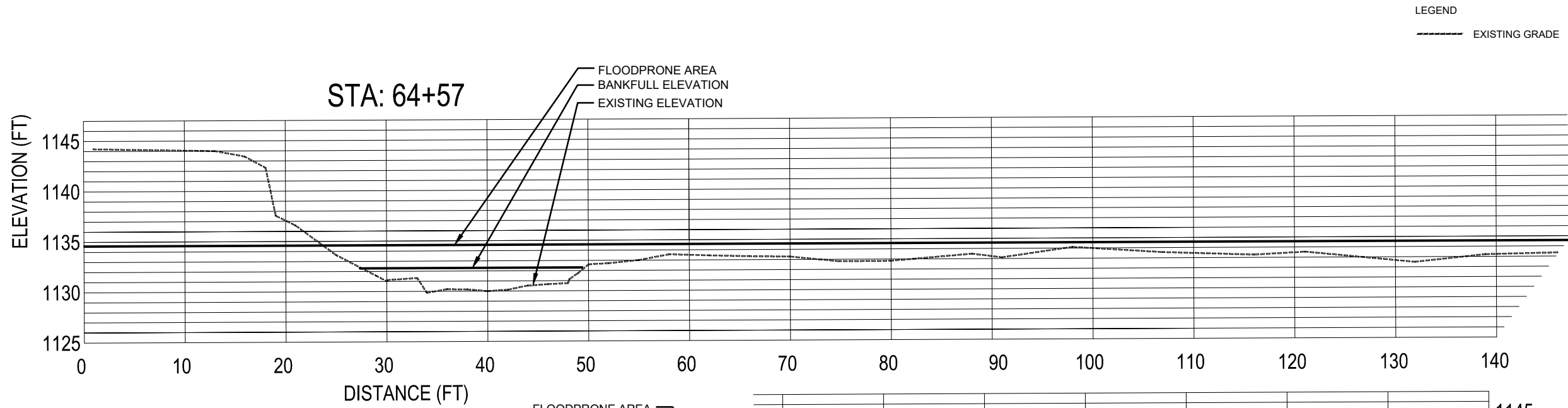
DATE	JANUARY 2020
DRAWN	JMGS/COD
DESIGNED	JACS
CHECKED	I
PROJECT #	J188372100

SHEET TITLE
CROSS SECTIONS
SHEET NUMBER

39

LAND USE #

60% DESIGN



#	DATE	DESCRIPTION

DATE	JANUARY 2020
DRAWN	MGS/COD
DESIGNED	I/ACS
CHECKED	I
PROJECT #	J188372100

SHEET TITLE
CROSS SECTIONS
SHEET NUMBER

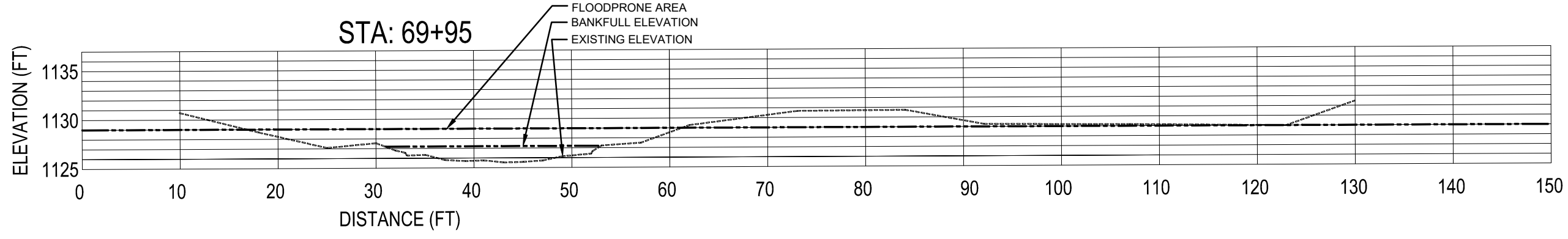
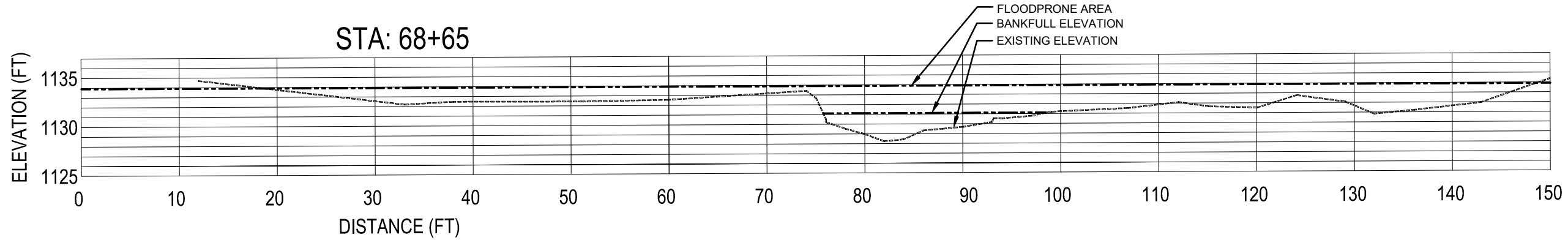
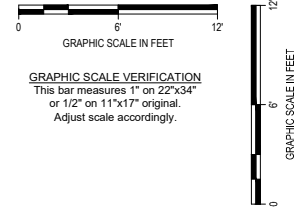
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LAND USE #

60% DESIGN

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LEGEND
 ----- EXISTING GRADE



EXISTING CROSS SECTIONS
 KNIFE RIVER
 ENVIRONMENTAL TROUBLE SHOOTERS
 LAKE COUNTY, MINNESOTA

#	DATE	DESCRIPTION

DATE | JANUARY 2020
 DRAWN | MGS/COD
 DESIGNED | ACS
 CHECKED | I
 PROJECT # | J188372100

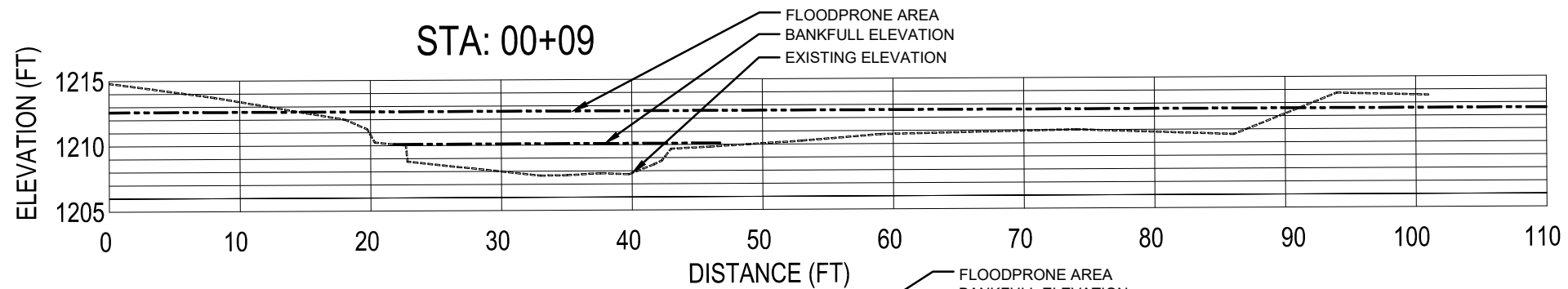
SHEET TITLE
CROSS SECTIONS

SHEET NUMBER
41

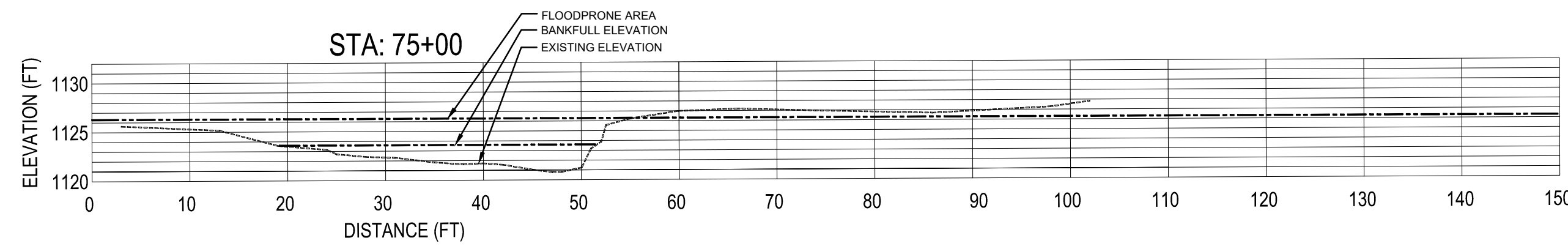
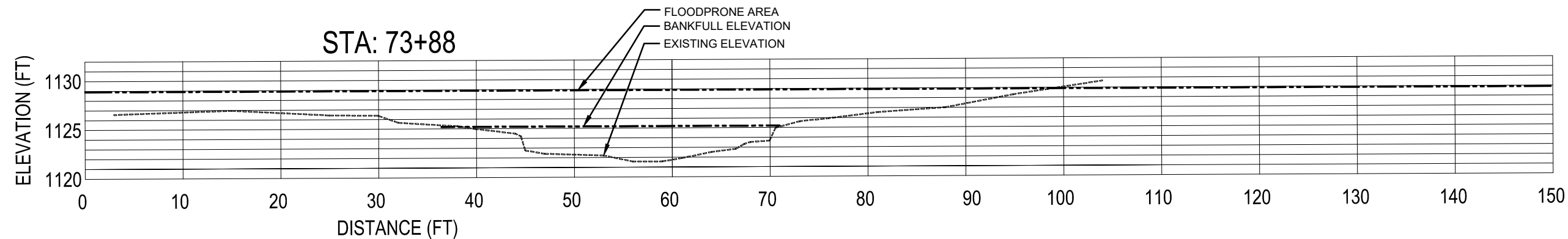
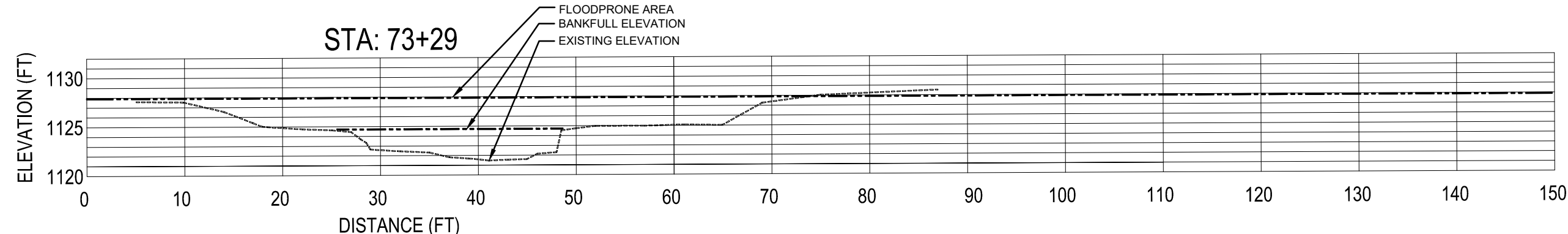
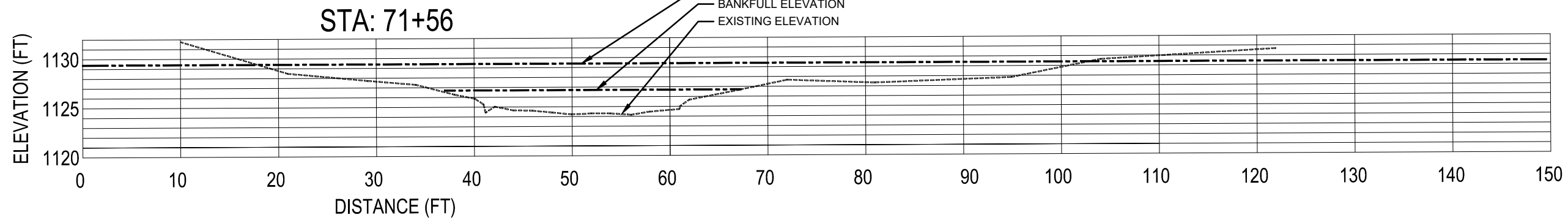
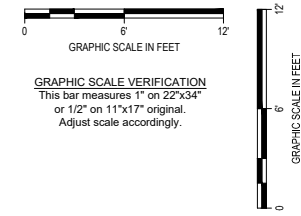
LAND USE # |

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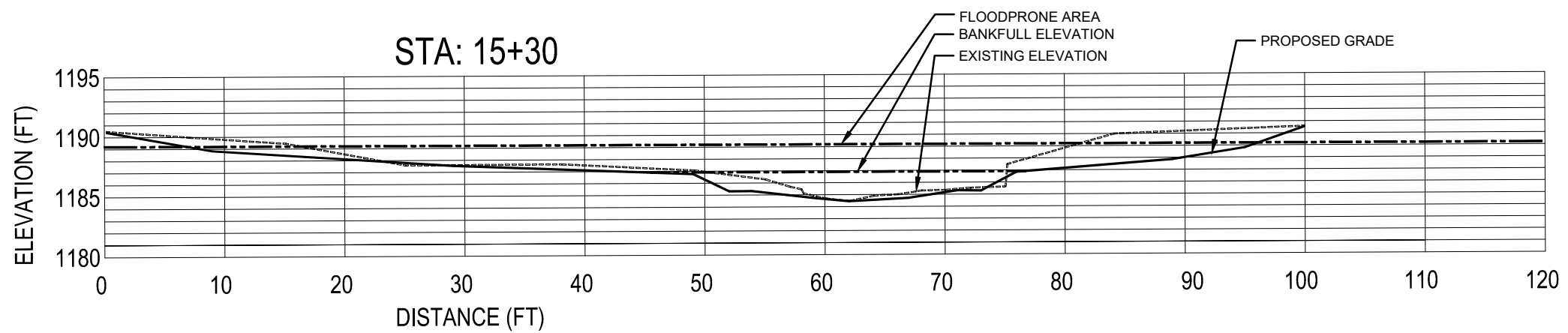
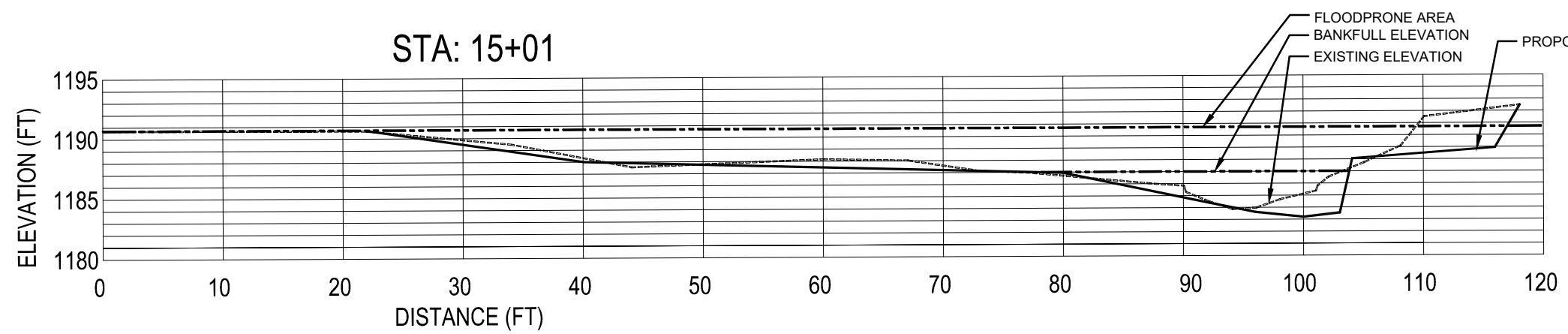
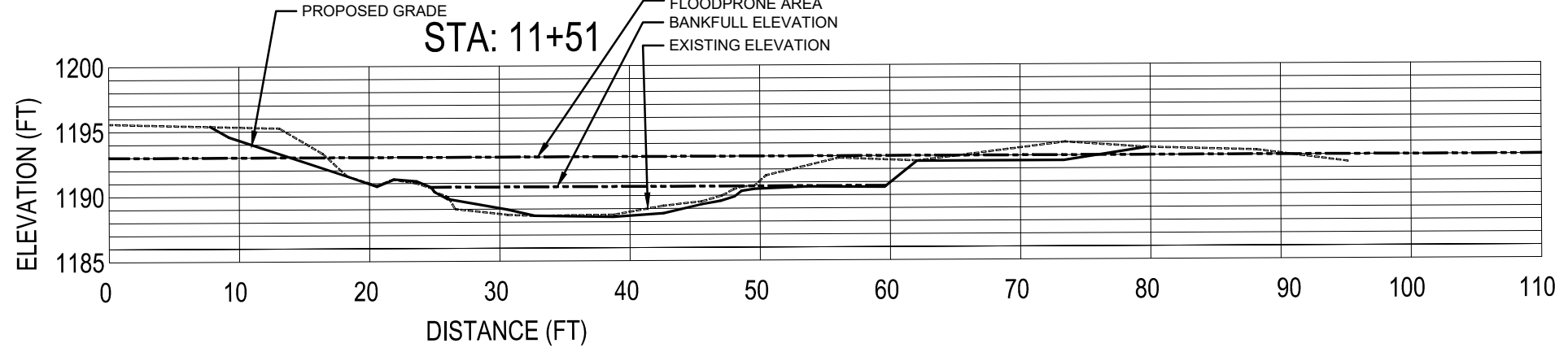
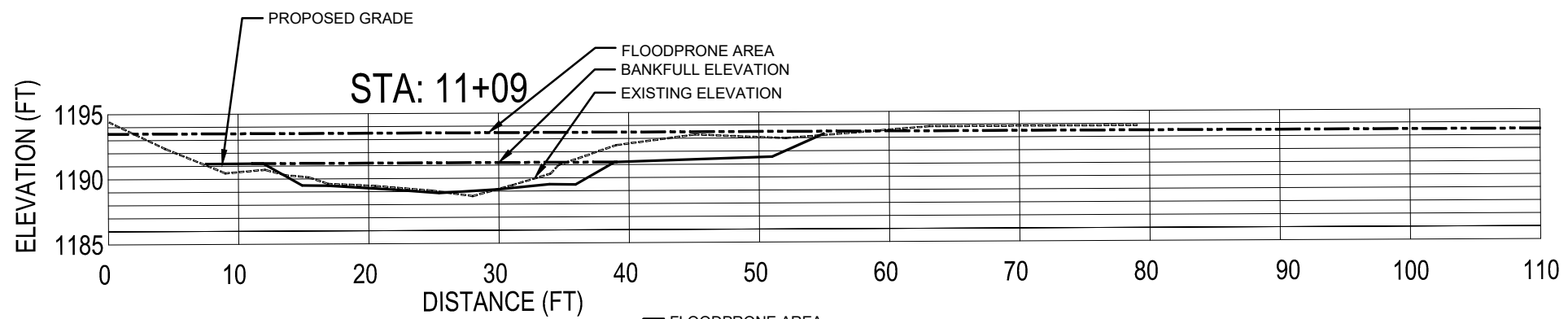
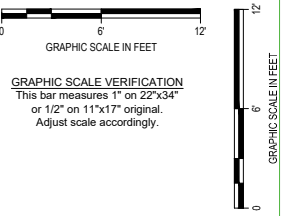
REFERENCE REACH CROSS SECTIONS
KNIFE RIVER
ENVIRONMENTAL TROUBLE SHOOTERS
LAKE COUNTY, MINNESOTA

#	DATE	DESCRIPTION

DATE	JANUARY 2020
DRAWN	JMGS/COD
DESIGNED	JACS
CHECKED	I
PROJECT #	J188372100
SHEET TITLE	REF. REACH SECTIONS
SHEET NUMBER	42
LAND USE #	

60% DESIGN

LEGEND
 — PROPOSED GRADE
 - - - EXISTING GRADE



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PROPOSED CROSS SECTIONS

KNIFE RIVER
 ENVIRONMENTAL TROUBLE SHOOTERS
 LAKE COUNTY, MINNESOTA

#	DATE	DESCRIPTION

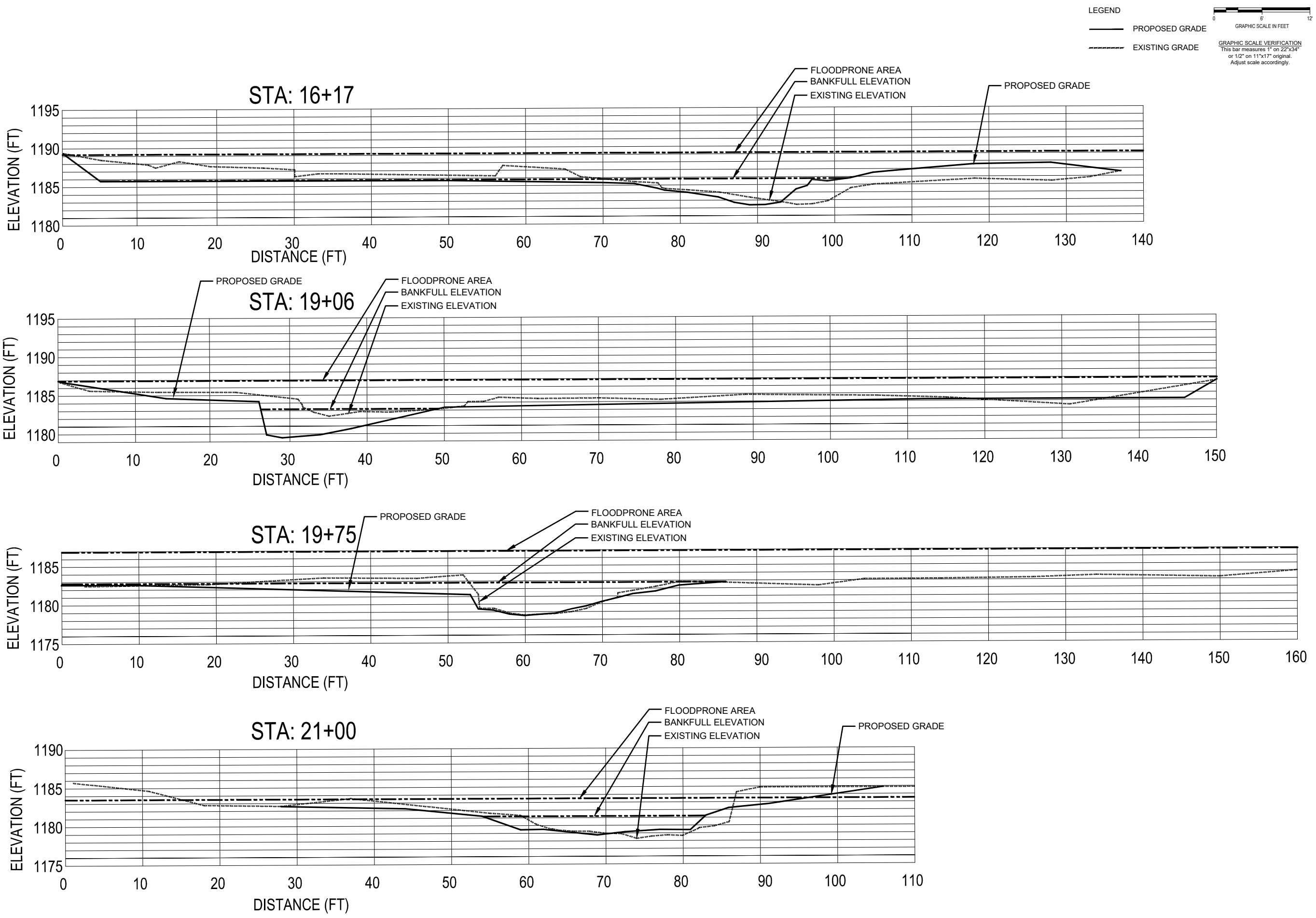
DATE	JANUARY 2020
DRAWN	JMGS/COD
DESIGNED	JACS
CHECKED	I
PROJECT #	J188372100

SHEET TITLE
 PROPOSED SECTIONS
 SHEET NUMBER

36

60% DESIGN

MADISON
 6140 COTTONWOOD DRIVE, SUITE A
 FITCHBURG, WISCONSIN 53719
 TEL: (608) 861-2365 FAX: (608) 861-2361
 www.cardnoinc.com



PROPOSED CROSS SECTIONS

KNIFE RIVER

ENVIRONMENTAL TROUBLE SHOOTERS

LAKE COUNTY, MINNESOTA

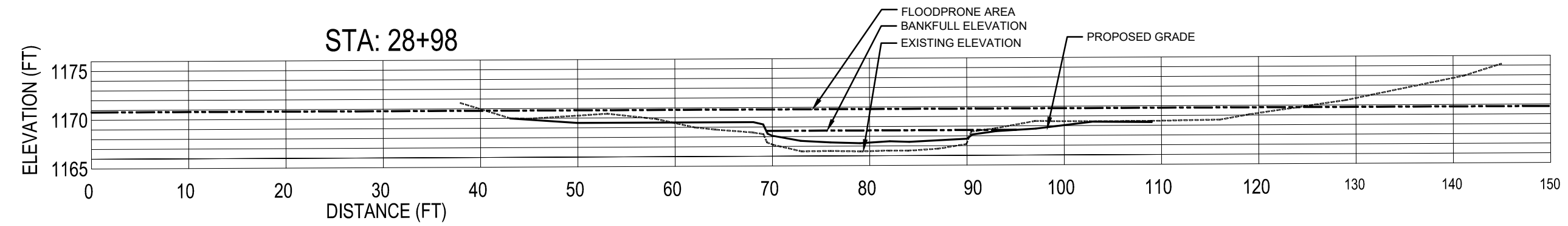
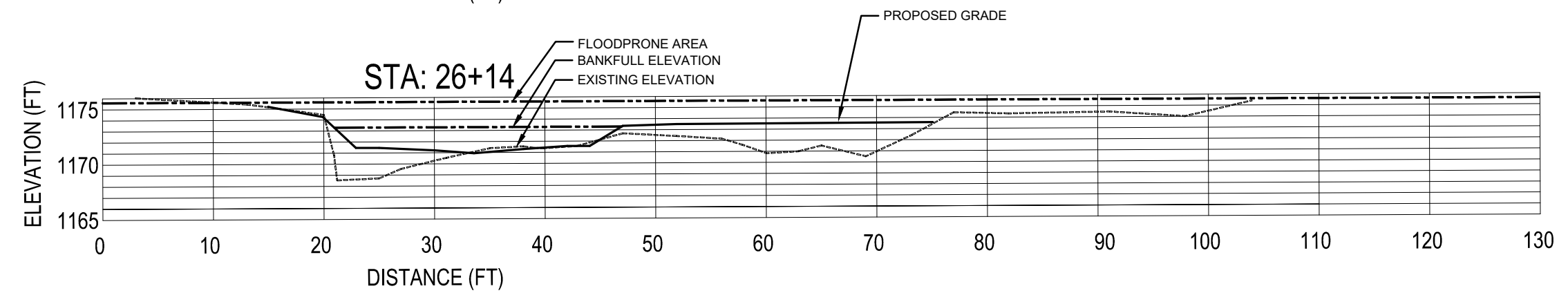
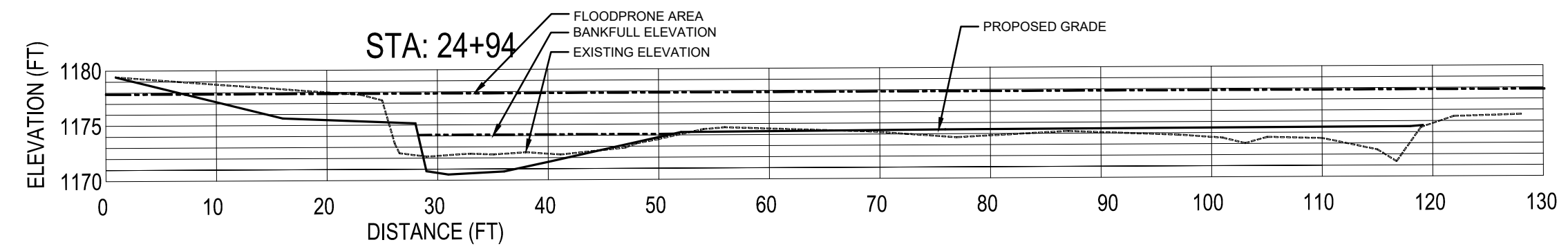
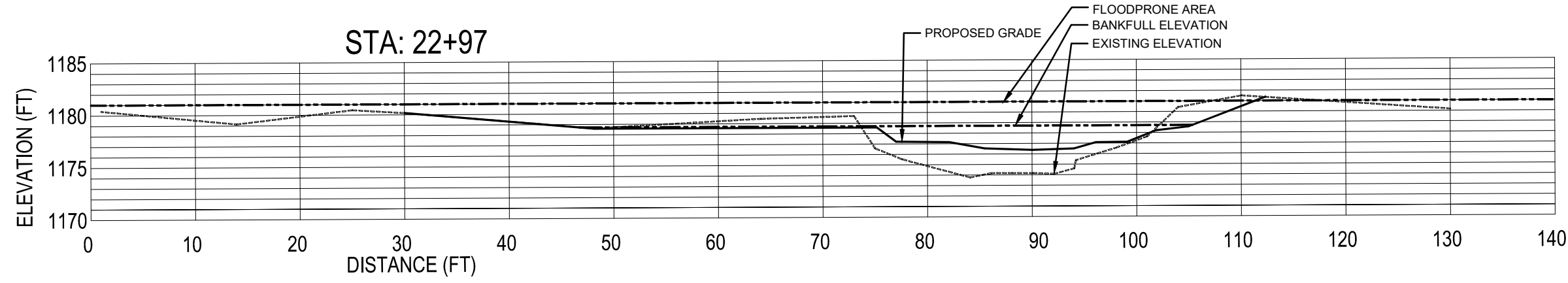
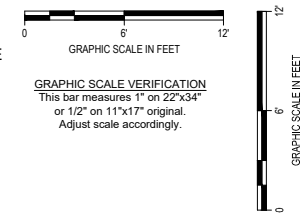
#	DATE	DESCRIPTION

DATE	JANUARY 2020
DRAWN	JMGS/COD
DESIGNED	JACS
CHECKED	I
PROJECT #	J188372100
SHEET TITLE	PROPOSED SECTIONS
SHEET NUMBER	44
LAND USE #	

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60% DESIGN

LEGEND
 — PROPOSED GRADE
 - - - EXISTING GRADE



PROPOSED CROSS SECTIONS
 KNIFE RIVER
 ENVIRONMENTAL TROUBLE SHOOTERS
 LAKE COUNTY, MINNESOTA

#	DATE	DESCRIPTION

DATE | JANUARY 2020
 DRAWN | MGS/COD
 DESIGNED | ACS
 CHECKED | I
 PROJECT # | J188372100

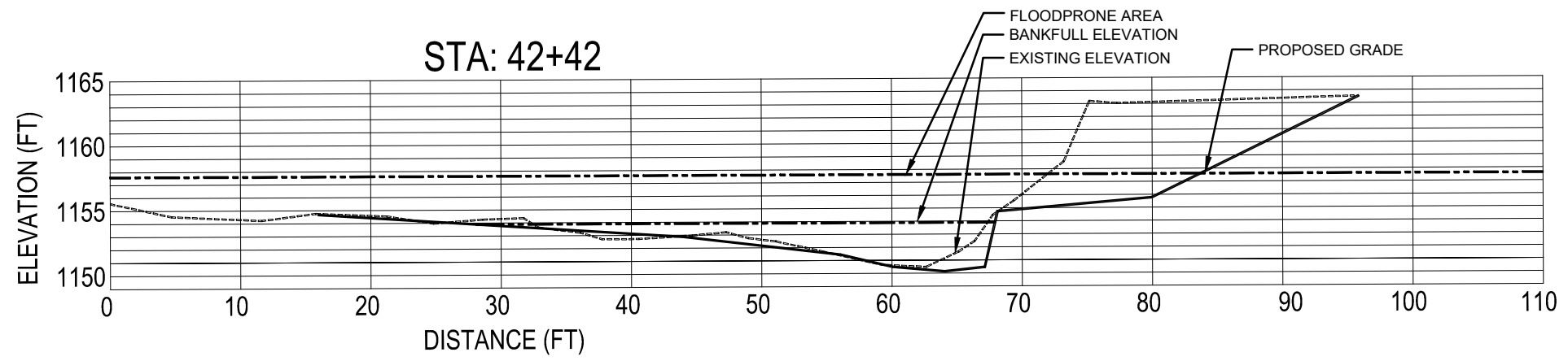
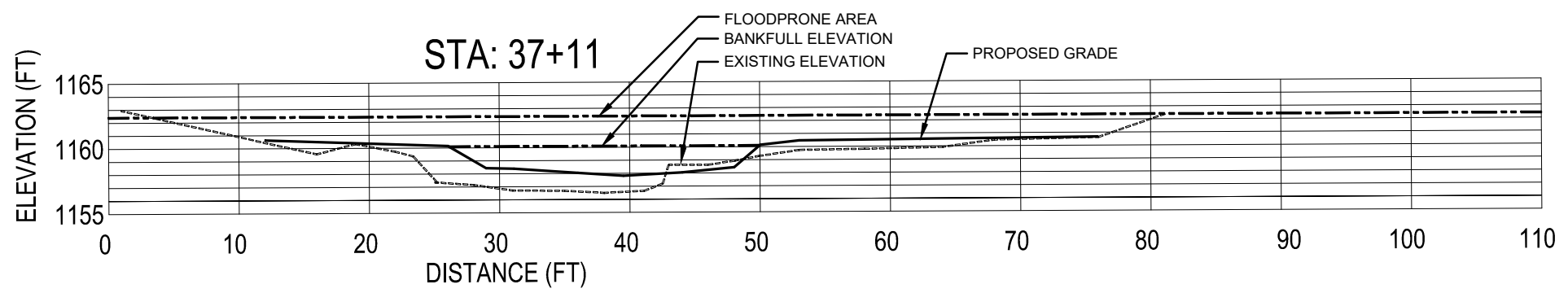
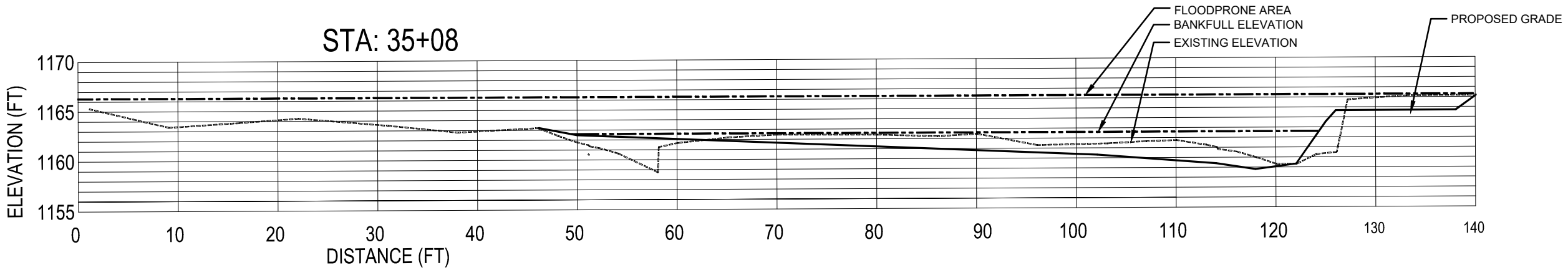
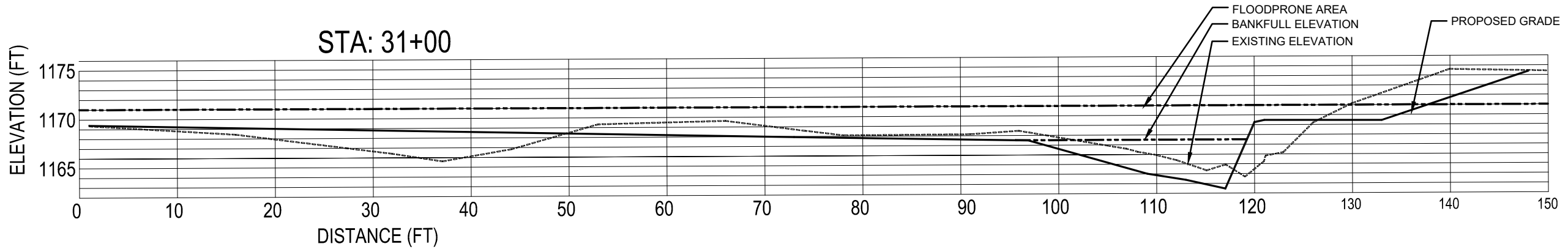
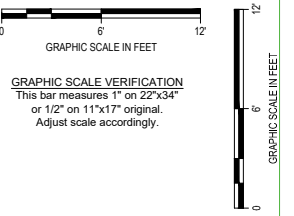
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PROPOSED SECTIONS
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45

60% DESIGN

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LEGEND
 — PROPOSED GRADE
 - - - EXISTING GRADE



PROPOSED CROSS SECTIONS
 KNIFE RIVER
 ENVIRONMENTAL TROUBLE SHOOTERS
 LAKE COUNTY, MINNESOTA

#	DATE	DESCRIPTION

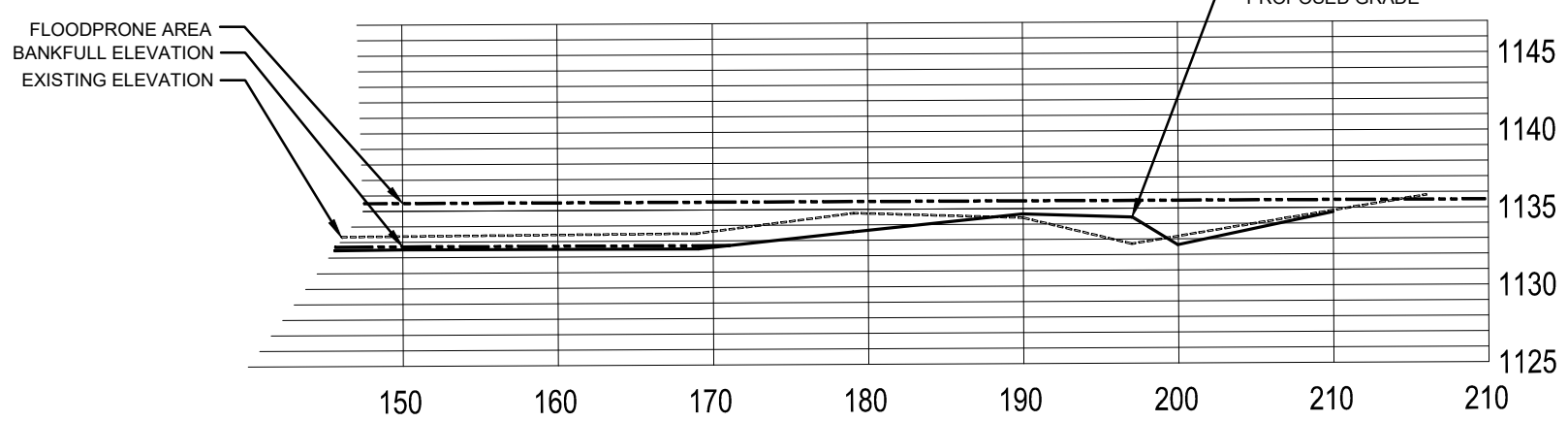
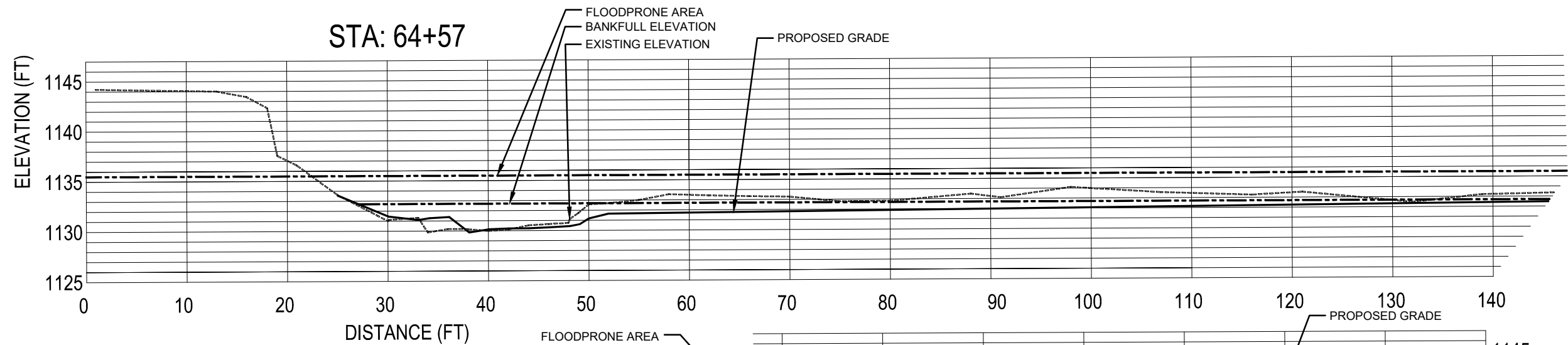
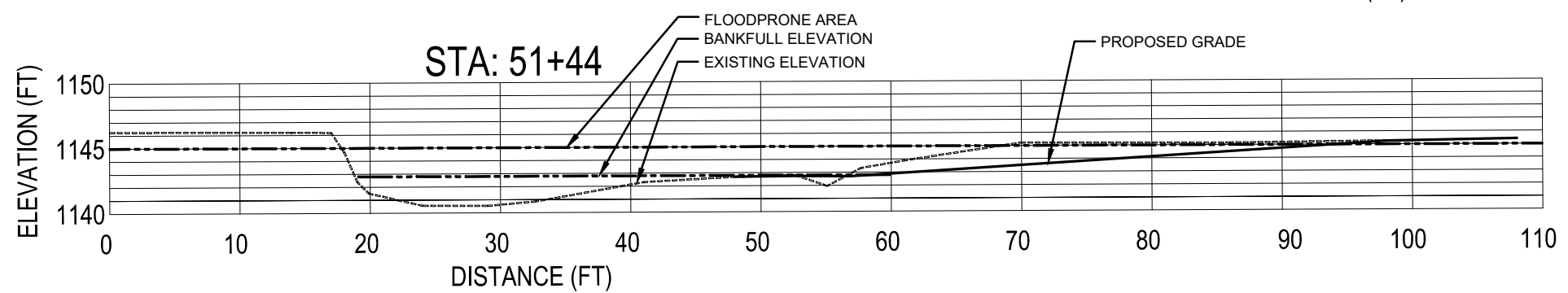
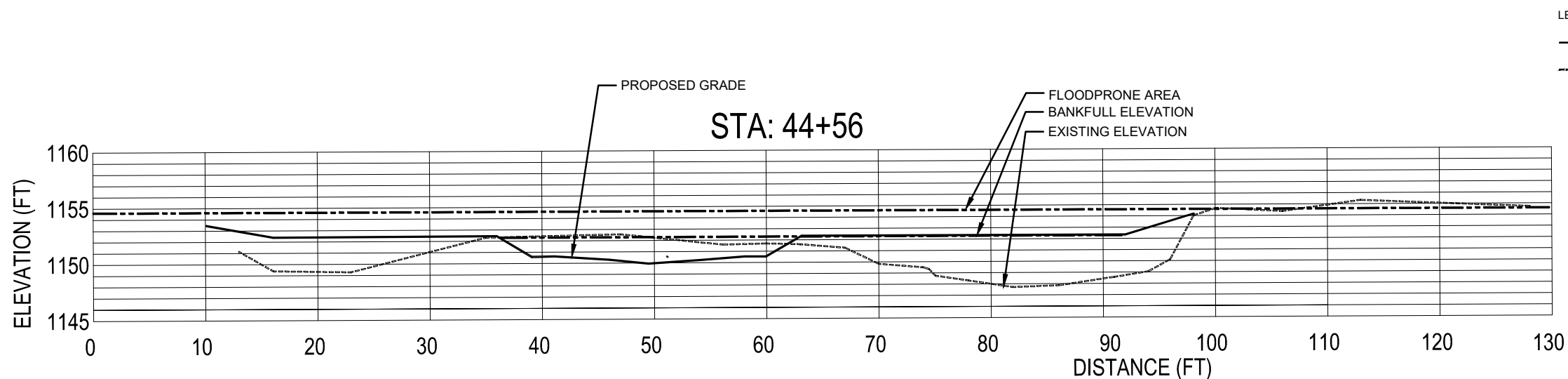
DATE | JANUARY 2020
 DRAWN | MGS/COD
 DESIGNED | ACS
 CHECKED | I
 PROJECT # | J188372100

SHEET TITLE
PROPOSED SECTIONS
 SHEET NUMBER

46
 LAND USE #

60% DESIGN

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**PROPOSED CROSS SECTIONS
 KNIFE RIVER
 ENVIRONMENTAL TROUBLE SHOOTERS
 LAKE COUNTY, MINNESOTA**

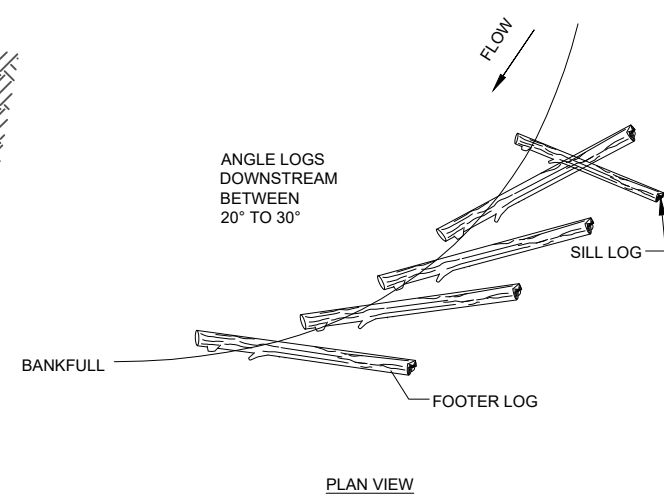
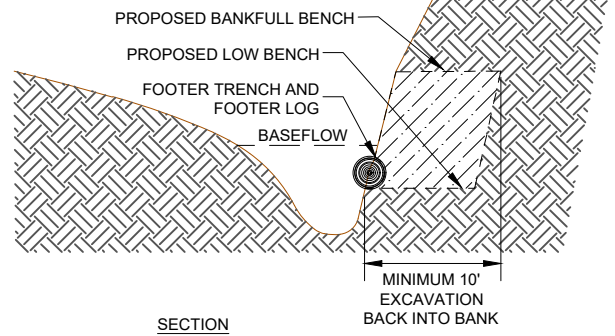
#	DATE	DESCRIPTION

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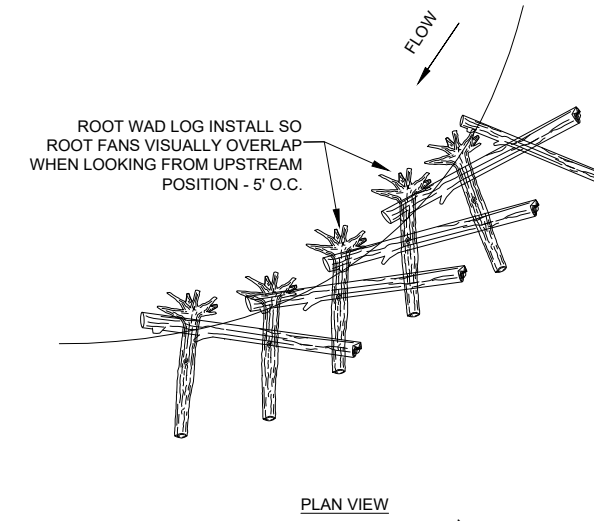
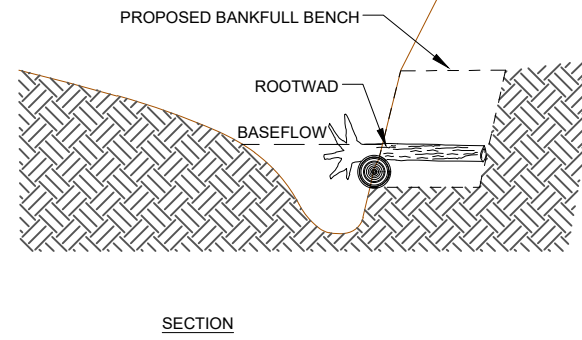
STEP 1:

EXCAVATE LOW BENCH FOR TOEWOOD MATERIAL. EXCAVATE FOOTER TRENCH IN LOWER BENCH AND PLACE FOOTER LOGS



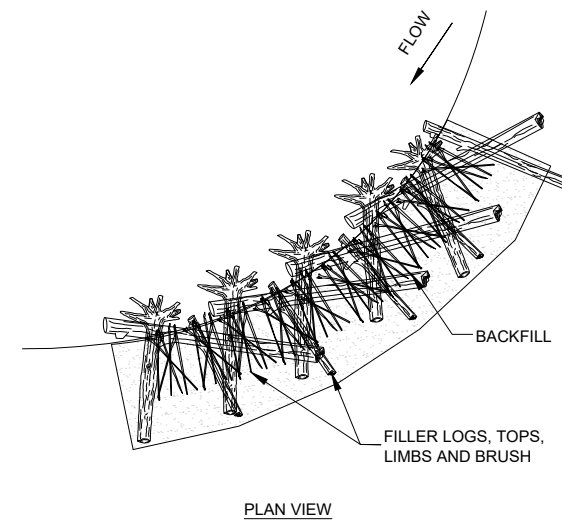
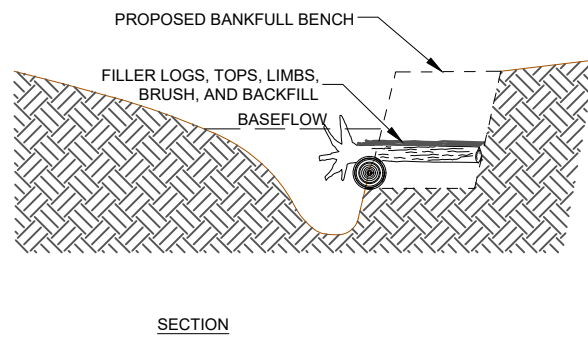
STEP 2:

PLACE ROOT WAD LOGS CANTILEVERED OVER FOOTING LOGS.



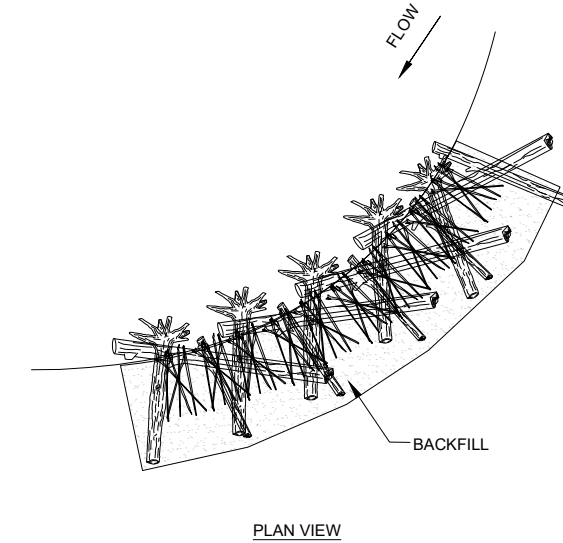
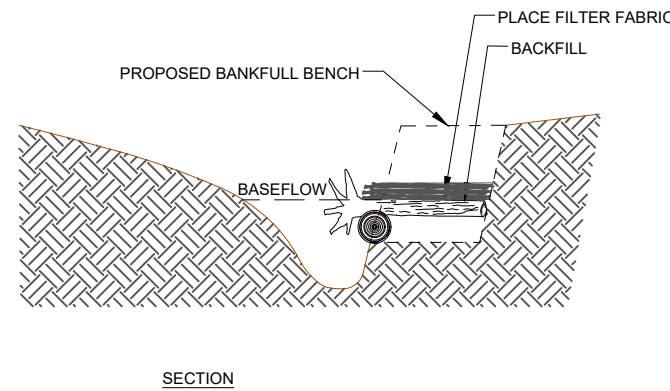
STEP 3:

PLACE FILLER MATERIAL (SMALL LOGS, LIMBS, TREE TOPS AND BRUSH) BETWEEN AND ON TOP OF THE ROOT WADS. THEN PLACE BACKFILL BETWEEN FILLER MATERIAL AND ROOTWADS IN LIFTS



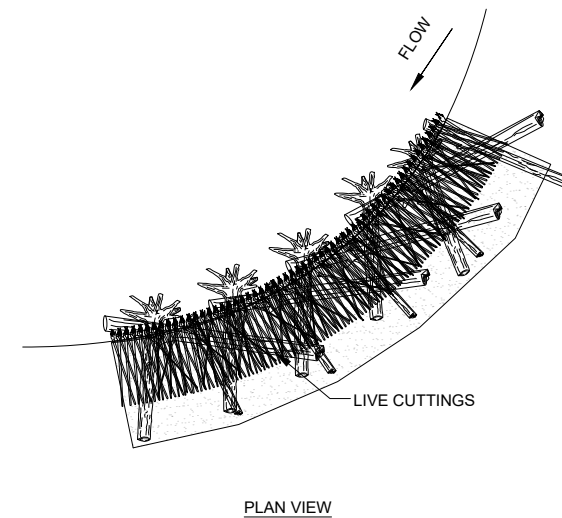
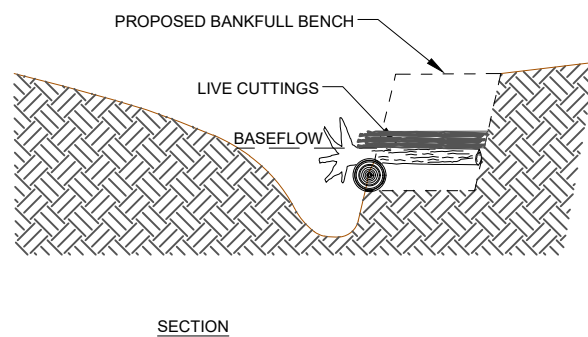
STEP 4:

CONTINUE TO BACKFILL WITH LOGS, LIMBS, TREE TOPS, AND FILLER MATERIAL TO 0.5' ABOVE BASEFLOW ELEVATION. COMPACT WITH EXCAVATOR BUCKET, BUT DO NOT REMOVE ALL VOIDS, ESPECIALLY ALONG TOE.



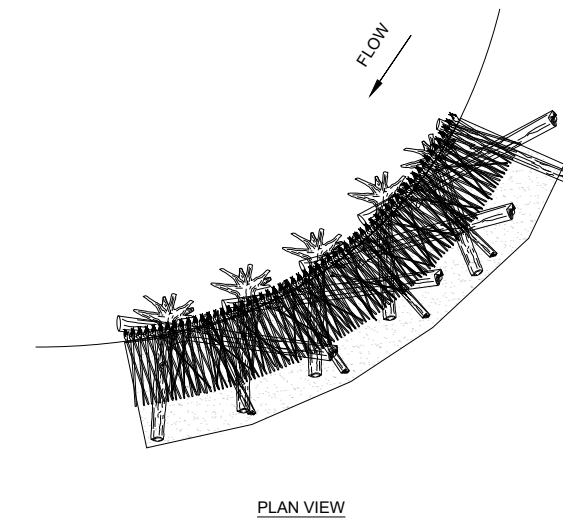
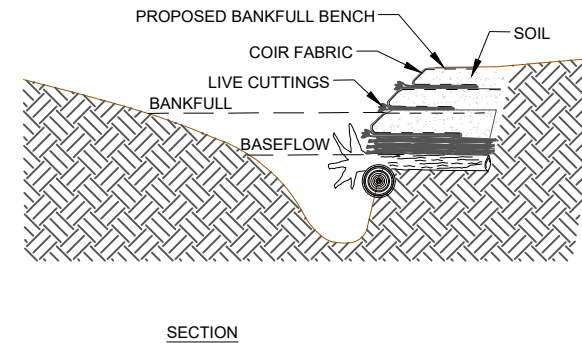
STEP 5:

PLACE LIVE BRUSH CUTTINGS AT LEAST 3' IN LENGTH AND 1/4" DIAMETER, 6 CUTTINGS/FOOT



STEP 6:

INSTALL COIR WRAPPED SOIL LIFTS AND LAYERS OF CUTTING BETWEEN SOIL LIFTS UP TO BANKFULL STAGE. WRAP ENDS OF FABRIC AND BURY WITH SILL LOGS AT TOP SOIL LIFT ELEVATION. COVER WITH SOIL. SEE TOEWOOD WITH SOIL LIFT DETAIL.



NOTES:

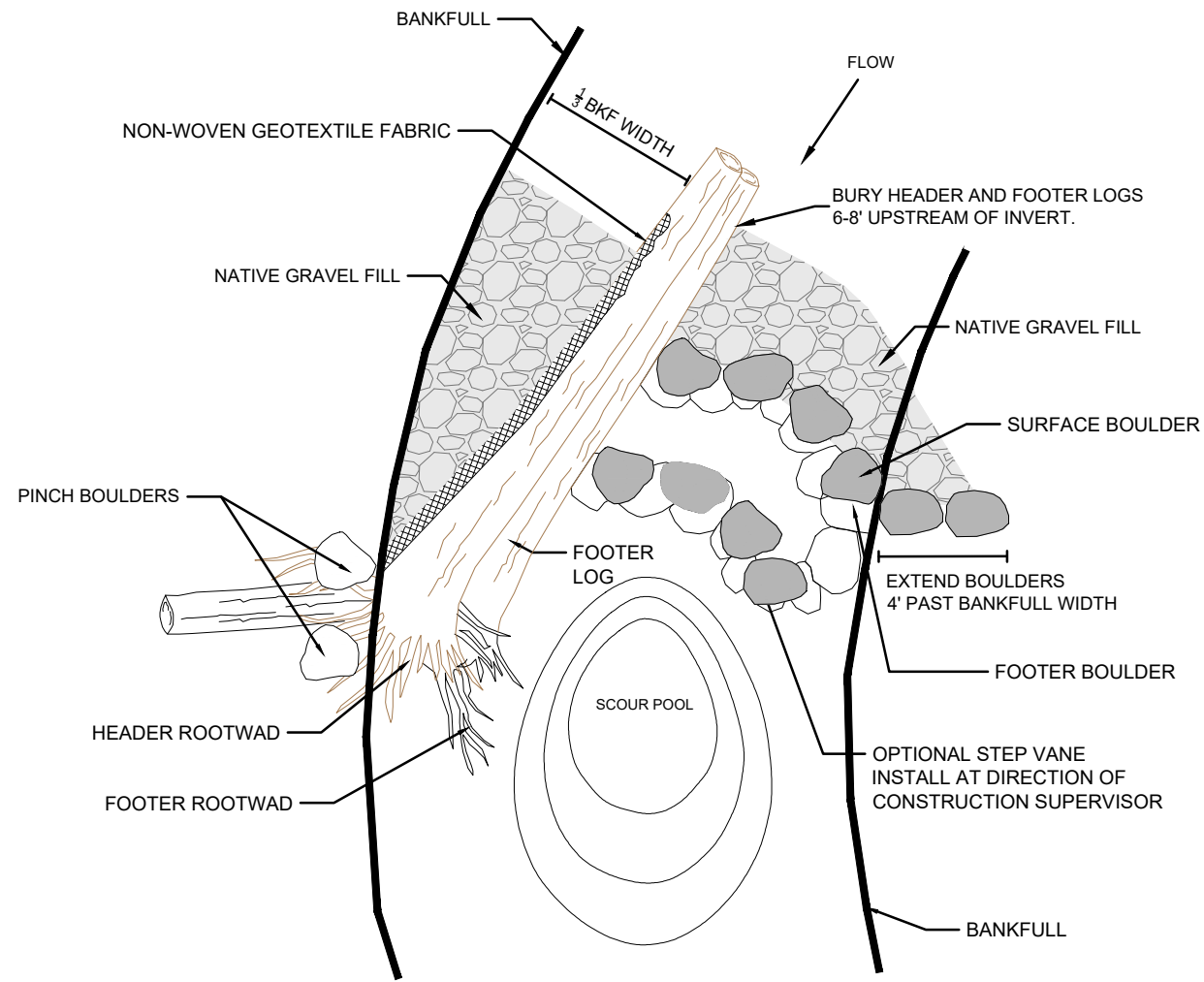
1. THE TOP OF THE ROOTWAD SHOULD BE INSTALLED AT AN ELEVATION SUCH THAT IT REMAINS INUNDATED DURING LOW FLOW EVENTS. THE ELEVATION SHOULD BE APPROXIMATELY 0.5' ABOVE THE DOWNSTREAM RIFFLE INVERT ELEVATION
2. THE WOOD SHOULD BE BURIED A MINIMUM OF 10 FEET INTO THE BANK.
3. LAYERS OF LIVE BRANCH CUTTINGS SHALL BE PLACED BETWEEN SOIL LIFTS.

7 TOEWOOD WITH SOIL LIFT
NOT TO SCALE

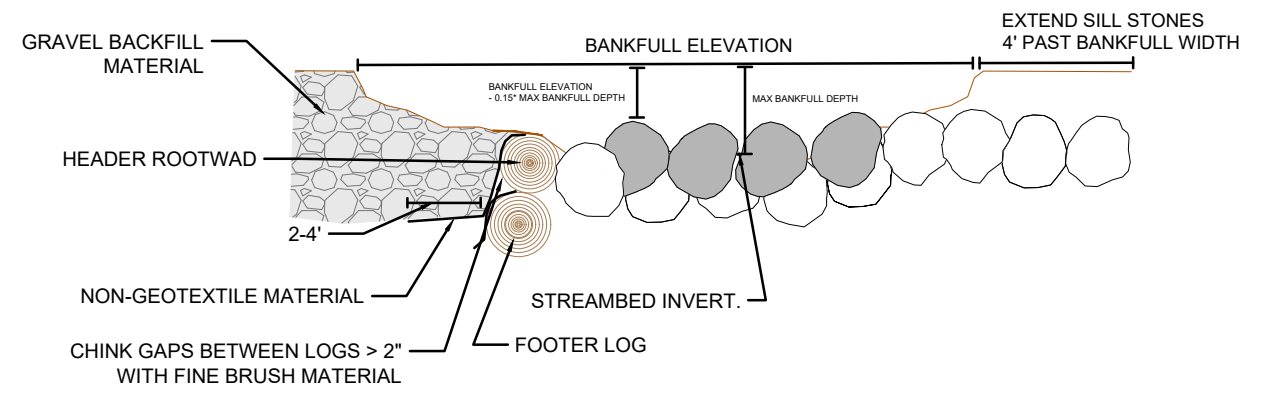
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#	DATE	DESCRIPTION

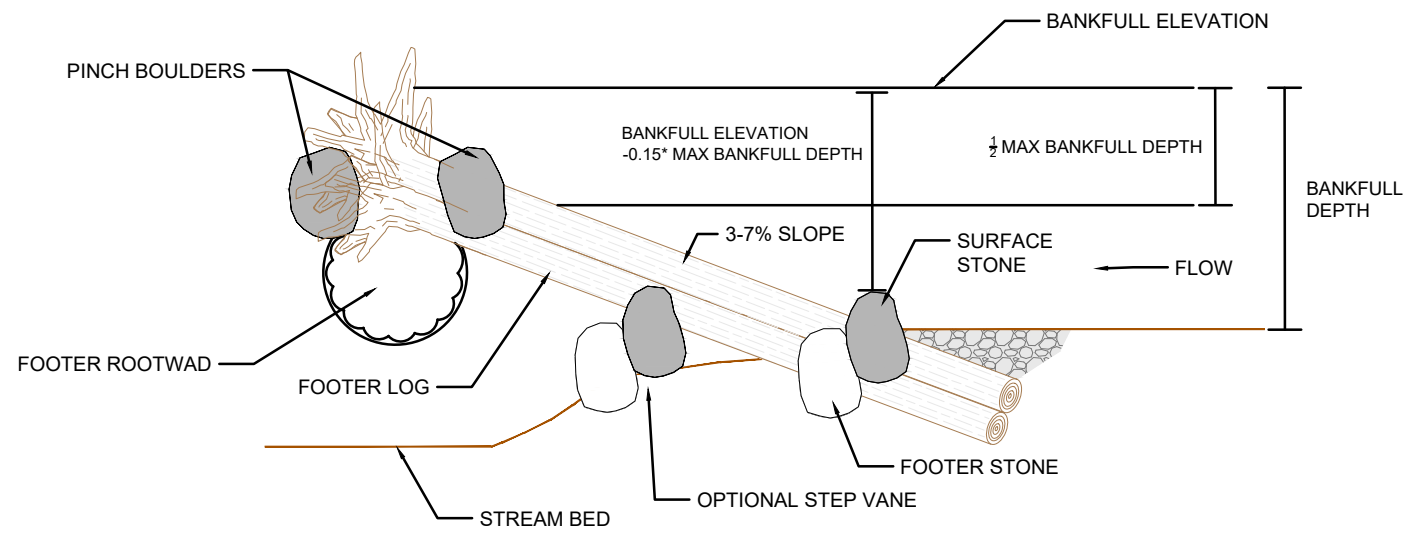
DATE	JANUARY 2020
DRAWN	MGS/COD
DESIGNED	JACS
CHECKED	I
PROJECT #	J188372100
SHEET TITLE	DETAILS
SHEET NUMBER	49



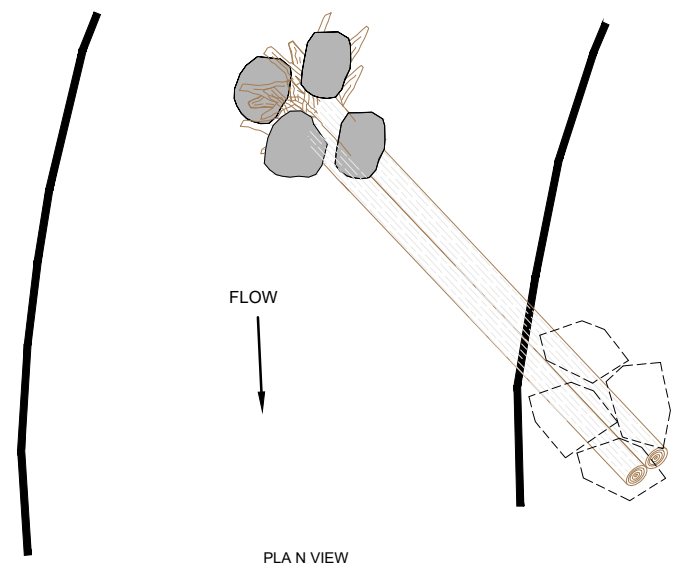
8 J-HOOK LOG VANE - PLAN VIEW
NOT TO SCALE



9 J-HOOK LOG VANE - CROSS SECTION VIEW
NOT TO SCALE



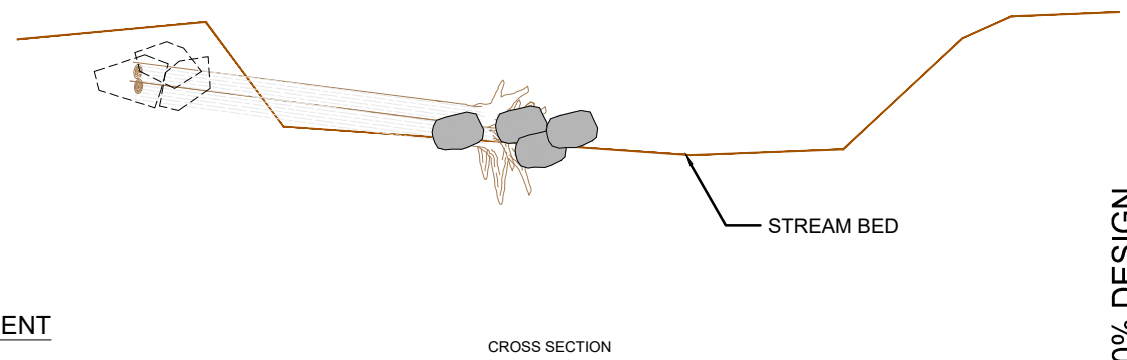
10 J-HOOK LOG VANE - PROFILE VIEW
NOT TO SCALE



LARGE WOOD ENHANCEMENT NOTES

1. Crown should be buried mid stream with the crown below the stream bed.
2. The back third of the log should be buried in the bank with a maximum elevation of the end below the bankfull height.
3. Use boulders to pin the crown and back end of the log into position.
4. Log angle into the streambed can be adjusted based on the length and width of the log.
5. Backfill upstream portion of log to same elevation as the trunk.
6. Flow should be pulled to the center of the channel during low flow stages.

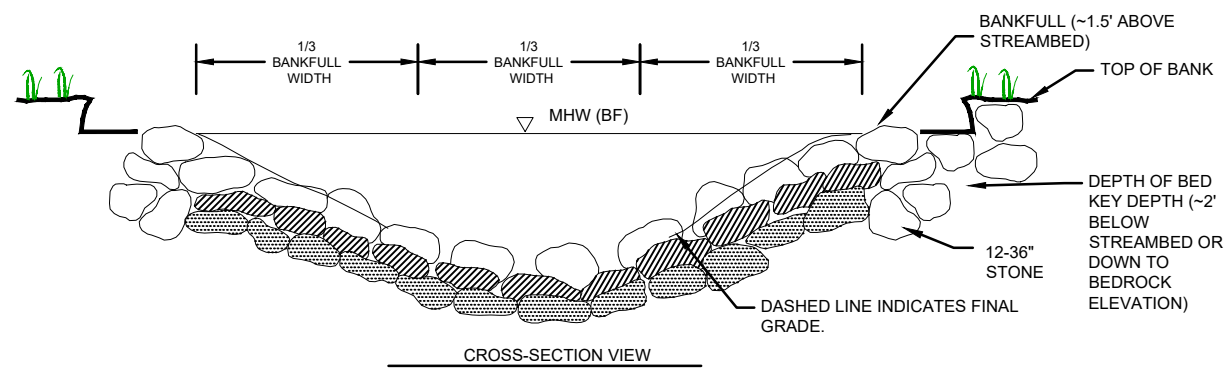
11 LARGE WOOD HABITAT ENHANCEMENT
NOT TO SCALE



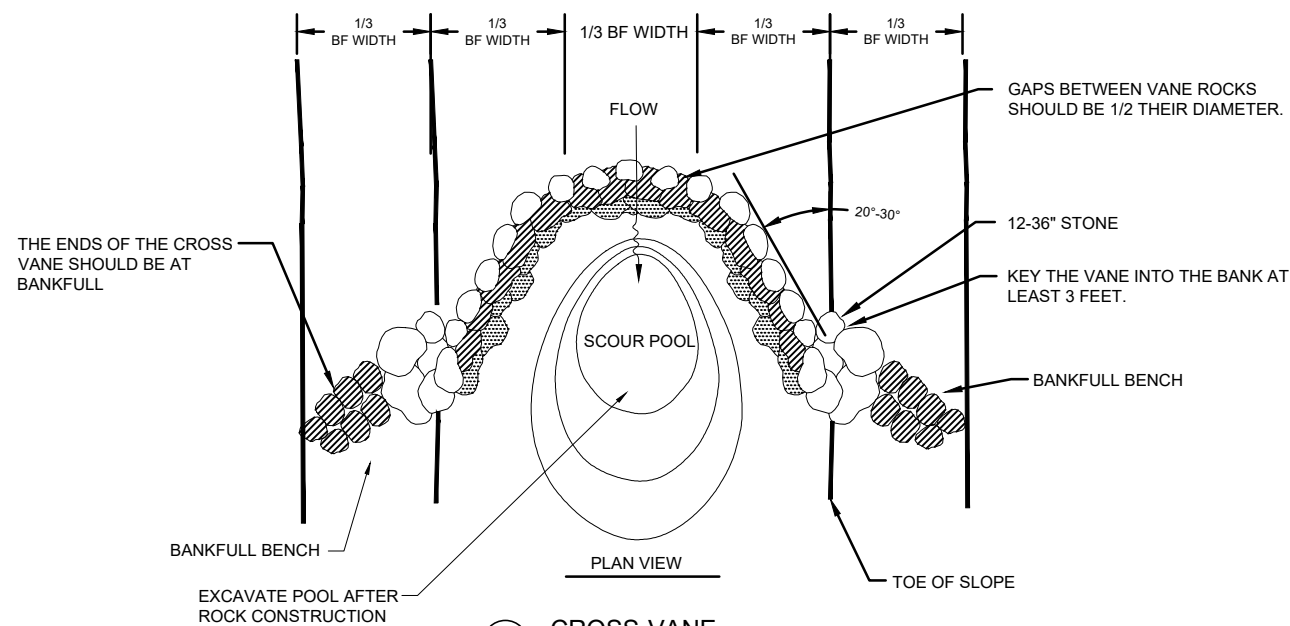
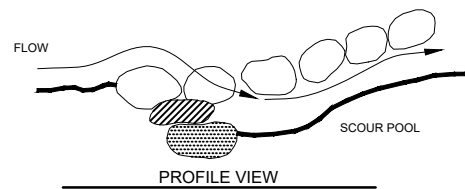
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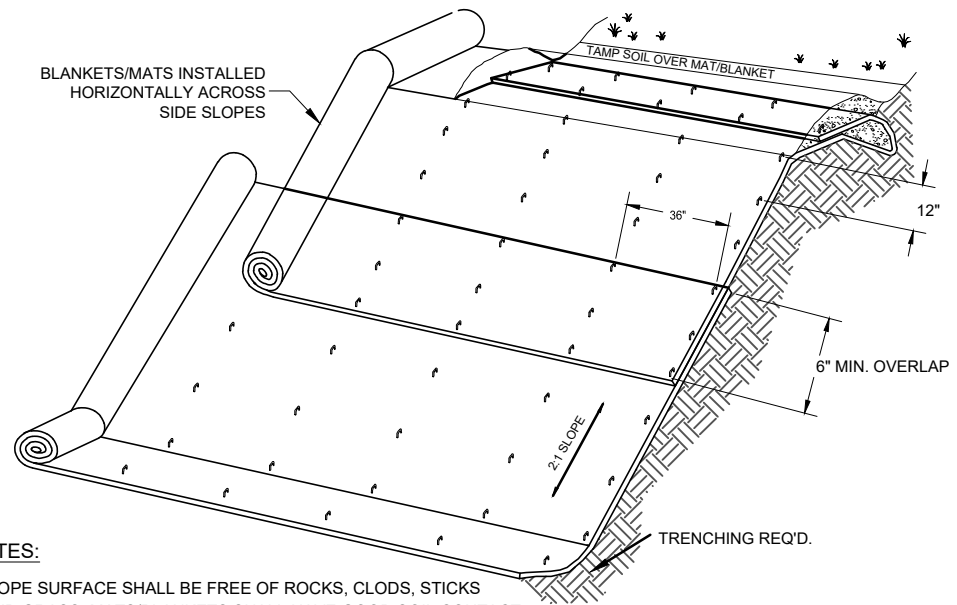
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NOTES:
 1. FINAL ORIENTATION AND PLACEMENT OF STRUCTURES MAY BE ADJUSTED IN THE FIELD BY PROJECT DESIGNER.

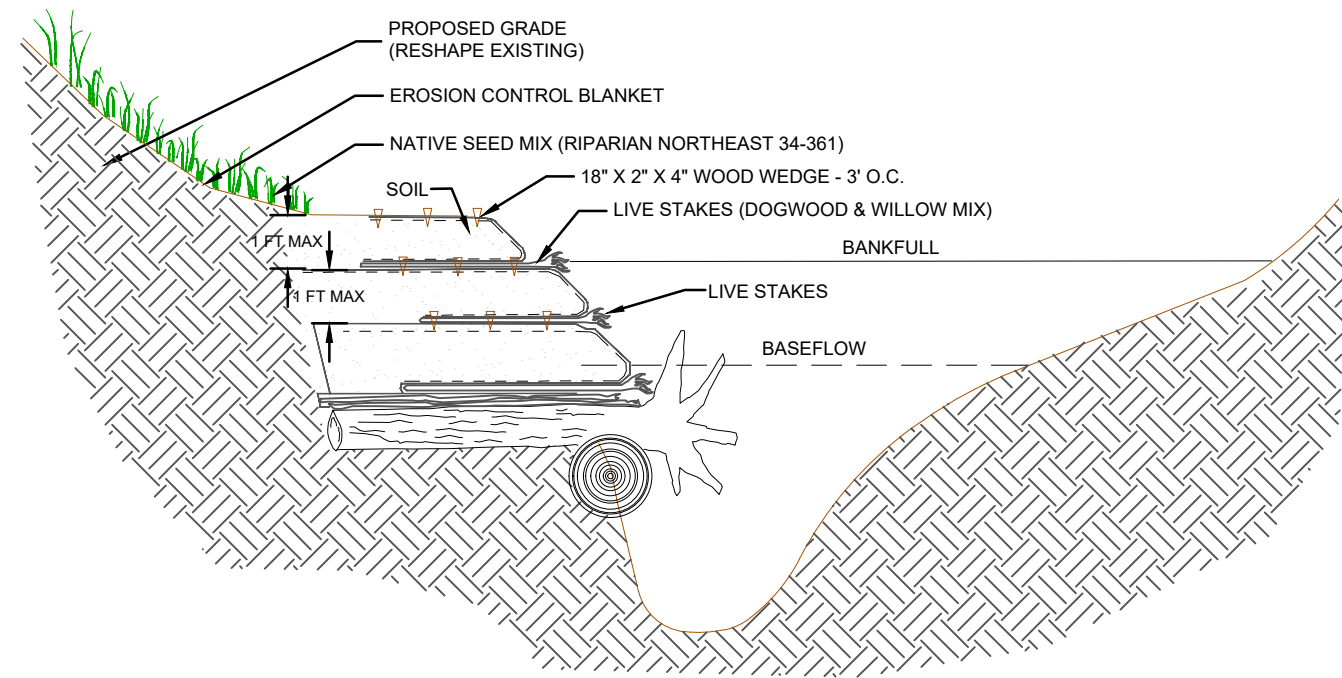


12 CROSS-VANE
 NOT TO SCALE



NOTES:
 1. SLOPE SURFACE SHALL BE FREE OF ROCKS, CLODS, STICKS AND GRASS. MATS/BLANKETS SHALL HAVE GOOD SOIL CONTACT.
 2. LAY BLANKETS LOOSELY AND STAKE OR STAPLE TO MAINTAIN DIRECT CONTACT WITH THE SOIL. DO NOT STRETCH.
 3. NORTH AMERICAN GREEN C125 BN TO BE INSTALLED ON ALL DISTURBED AREAS AS SHOWN ON SHEET 4 & 5

13 TYPICAL NAG C125 BN BLANKET INSTALLATION
 NOT TO SCALE

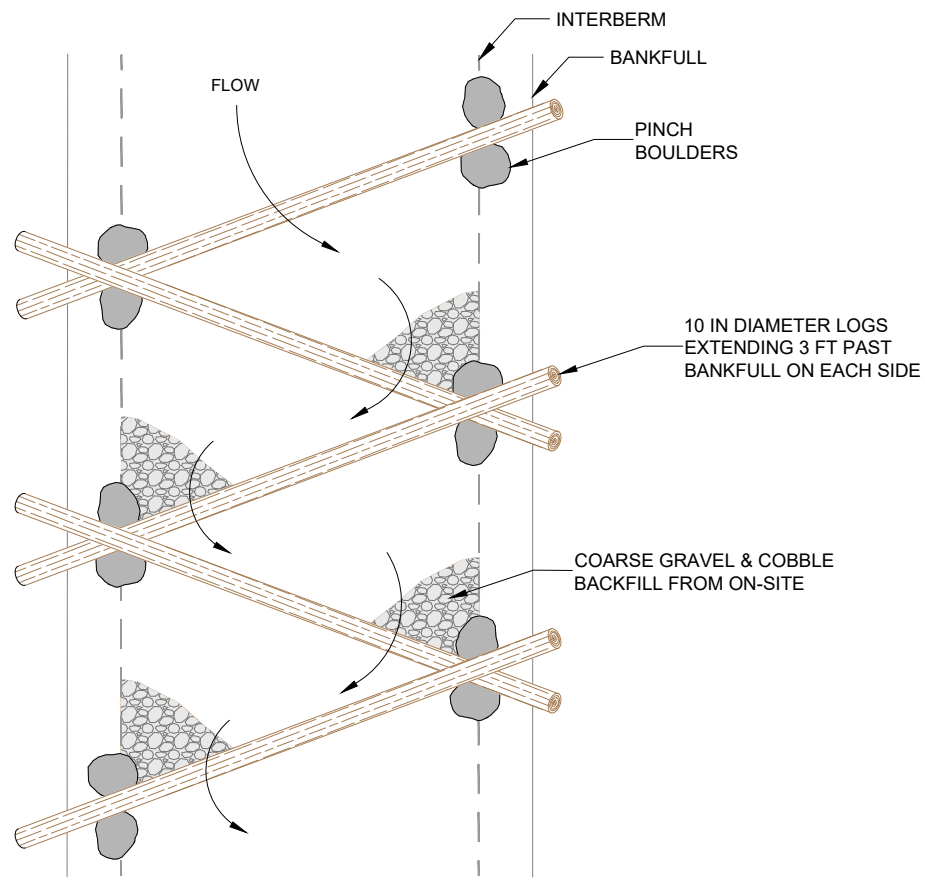


14 TOE WOOD - SOIL LIFT APPLICATION DETAIL
 NOT TO SCALE

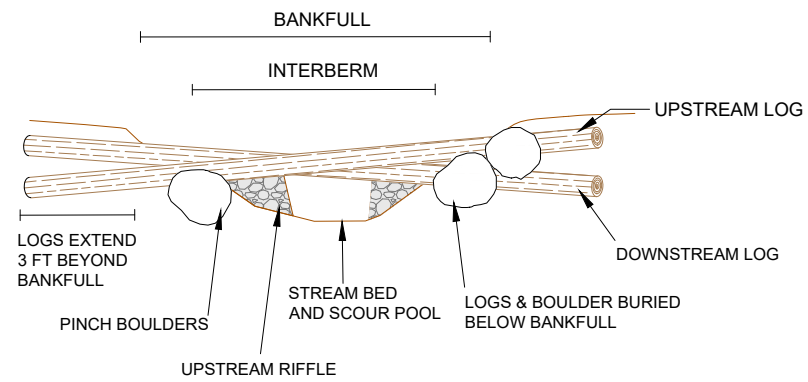
#	DATE	DESCRIPTION

DATE	JANUARY 2020
DRAWN	JMSS/COD
DESIGNED	JACS
CHECKED	I
PROJECT #	J188372100
SHEET TITLE	DETAILS
SHEET NUMBER	51

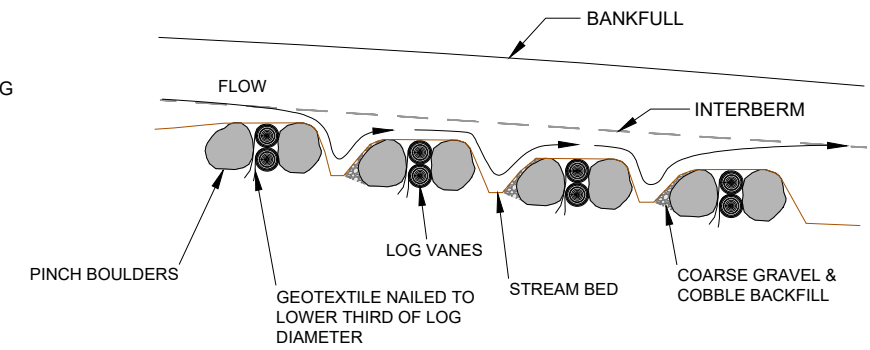
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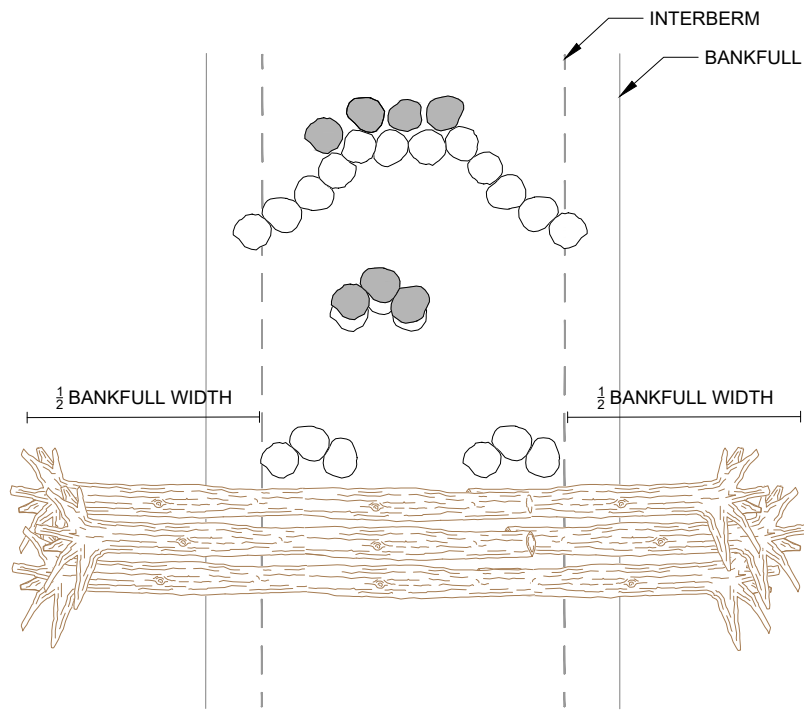
15 LOG ROLLER - PLAN VIEW
NOT TO SCALE



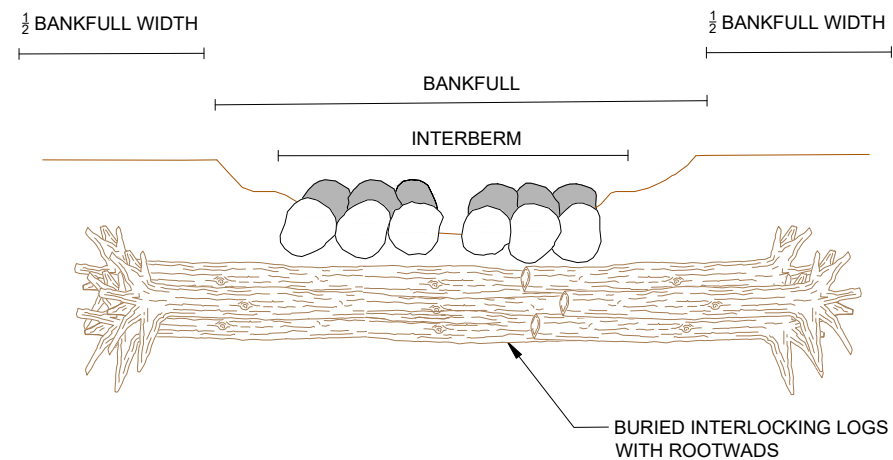
16 LOG ROLLER - CROSS SECTION
NOT TO SCALE



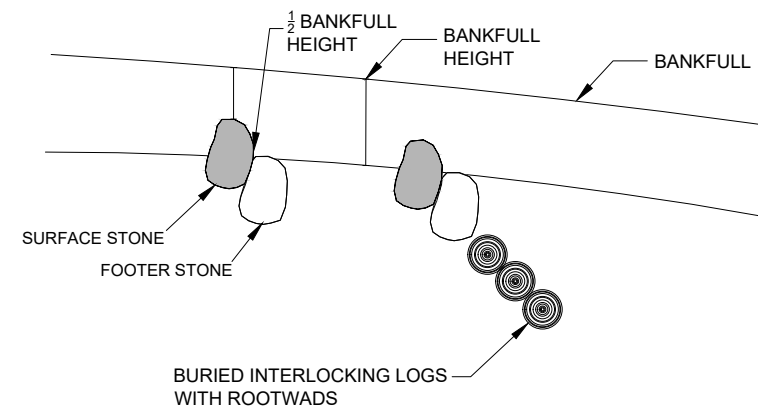
17 LOG ROLLER - PROFILE
NOT TO SCALE



18 SUBGRADE LOG VANE DETAILS - PLAN VIEW
NOT TO SCALE



19 SUBGRADE LOG VANE - CROSS SECTION
NOT TO SCALE

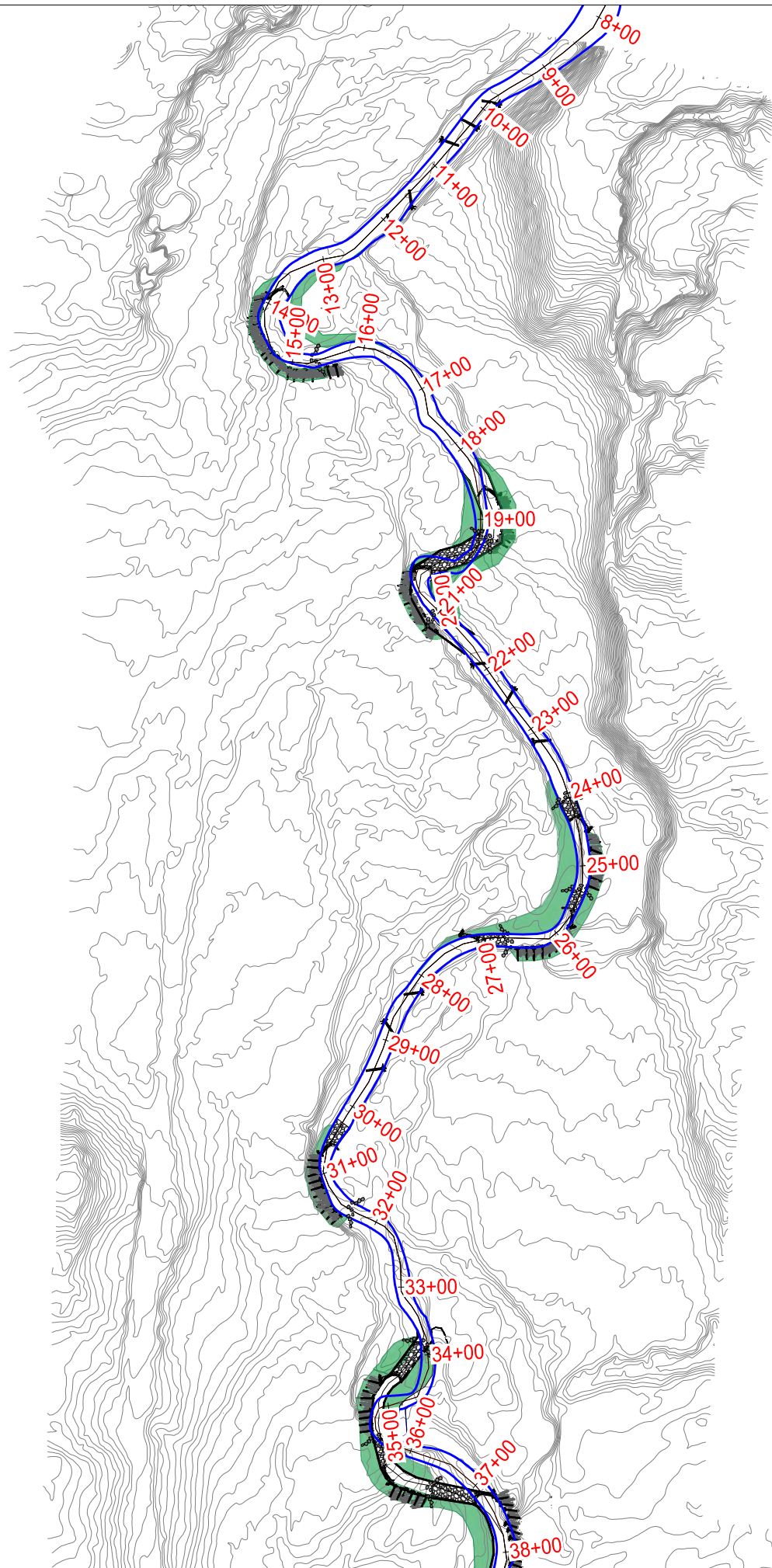


20 SUBGRADE LOG VANE - PROFILE
NOT TO SCALE

#	DATE	DESCRIPTION

DATE	JANUARY 2020
DRAWN	I MGS
DESIGNED	I MP
CHECKED	I
PROJECT #	J188372100
SHEET TITLE	DETAILS
SHEET NUMBER	52

60% DESIGN



TREE LIST

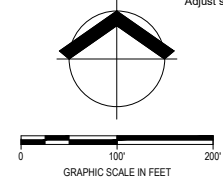
Inside Point Bar	Spacing	Plant Material
Adjacent to Stream		
Sand bar willow	4 ft o.c.	Live Stakes
Areas periodically flooded		
Tamarack	8-20 ft o.c.	Container
White spruce	8-20 ft o.c.	Container
Silver maple	8-20 ft o.c.	Container
Red maple	8-20 ft o.c.	Container
Bur oak	8-20 ft o.c.	Container
Black willow	8-20 ft o.c.	Container
Red osier dogwood	4 ft o.c.	Container
Areas of higher elevation		
Yellow birch	8-20 ft o.c.	Container
Mountain ash	8-20 ft o.c.	Container
Bur oak	8-20 ft o.c.	Container
White pine	8-20 ft o.c.	Container
Red pine	8-20 ft o.c.	Container
High bush cranberry	8-16 ft o.c.	Container
Outside Bends		
Non-Toewood Banks		
Speckled alder	8-16 ft o.c.	Container
Sandbar willow	4 ft o.c.	Live Stakes
Black willow	4 ft o.c.	Container
Tamarack	8-20 ft o.c.	Container
White spruce	8-20 ft o.c.	Container
Silver maple	8-20 ft o.c.	Container
Red Maple	8-20 ft o.c.	Container
Toewood Bench		
White pine	8-20 ft o.c.	Container
Red pine	8-20 ft o.c.	Container
Basswood	8-20 ft o.c.	Container
Paper birch	8-20 ft o.c.	Container
Yellow birch	8-20 ft o.c.	Container
Red-osier dogwood	8-16 ft o.c.	Container
High bush cranberry	8-16 ft o.c.	Container
Juneberry	8-16 ft o.c.	Container
Chokeberry	8-16 ft o.c.	Container
Smooth sumac	8-16 ft o.c.	Container

SEED MIXES

MN-DOT Seed Mix 34-361 Riparian Northeast				
Common Name	Scientific Name	Rate (lb/acre)	Percent of Mix	Seeds/Sq ft
American slough grass	<i>Beckmannia syzigachne</i>	1.5	4.78%	27.64
Bluejoint	<i>Calamagrostis canadensis</i>	0.05	0.19%	6
Riverbank wild rye	<i>Elymus riparius</i>	0.5	1.57%	0.53
Virginia wild rye	<i>Elymus virginicus</i>	2	6.33%	3.08
Tall manna grass	<i>Glyceria grandis</i>	0.25	0.80%	6.5
Fowl manna grass	<i>Glyceria striata</i>	0.09	0.29%	3
Rice cut grass	<i>Leersia oryzoides</i>	0.15	0.49%	1.93
Fowl grass	<i>Poa palustris</i>	0.7	2.23%	33.5
Total Grasses		5.25	16.68%	82.18
Tussock sedge	<i>Carex stricta</i>	0.04	0.13%	0.8
Pointed broom sedge	<i>Carex scaparia</i>	0.06	0.21%	2
Fox sedge	<i>Carex vulpinoidea</i>	0.2	0.65%	7.5
Path rush	<i>Juncus tenuis</i>	0.03	0.09%	10
Dark green bulrush	<i>Scirpus atrovirens</i>	0.12	0.38%	20
Woolgrass	<i>Scirpus cyperinus</i>	0.05	0.15%	30
Total Sedges and Rushes		0.5	1.61%	70.3
Marsh milkweed	<i>Asclepias incarnata</i>	0.12	0.38%	0.21
Flat-topped aster	<i>Doellingeria umbellata</i>	0.04	0.13%	1
Common boneset	<i>Eupatorium perfoliatum</i>	0.05	0.16%	3
Grass-leaved goldenrod	<i>Euthamia graminifolia</i>	0.07	0.22%	9
Spotted joe pye weed	<i>Eutrochium maculatum</i>	0.11	0.34%	3.7
Giant sunflower	<i>Helianthus giganteus</i>	0.07	0.22%	0.25
Spotted touch-me-not	<i>Impatiens capensis</i>	0.03	0.11%	0.05
Blue monkey flower	<i>Mimulus ringens</i>	0.02	0.05%	13
Giant goldenrod	<i>Solidago gigantea</i>	0.02	0.05%	1.5
Blue vervain	<i>Verbena hastata</i>	0.22	0.68%	7.35
Total Forbs		0.75	2.34%	39.06
Oats or winter wheat		25	79.37%	11.14
Total Cover Crop		25	79.37%	11.14
Totals		31.5	100.00%	202.67

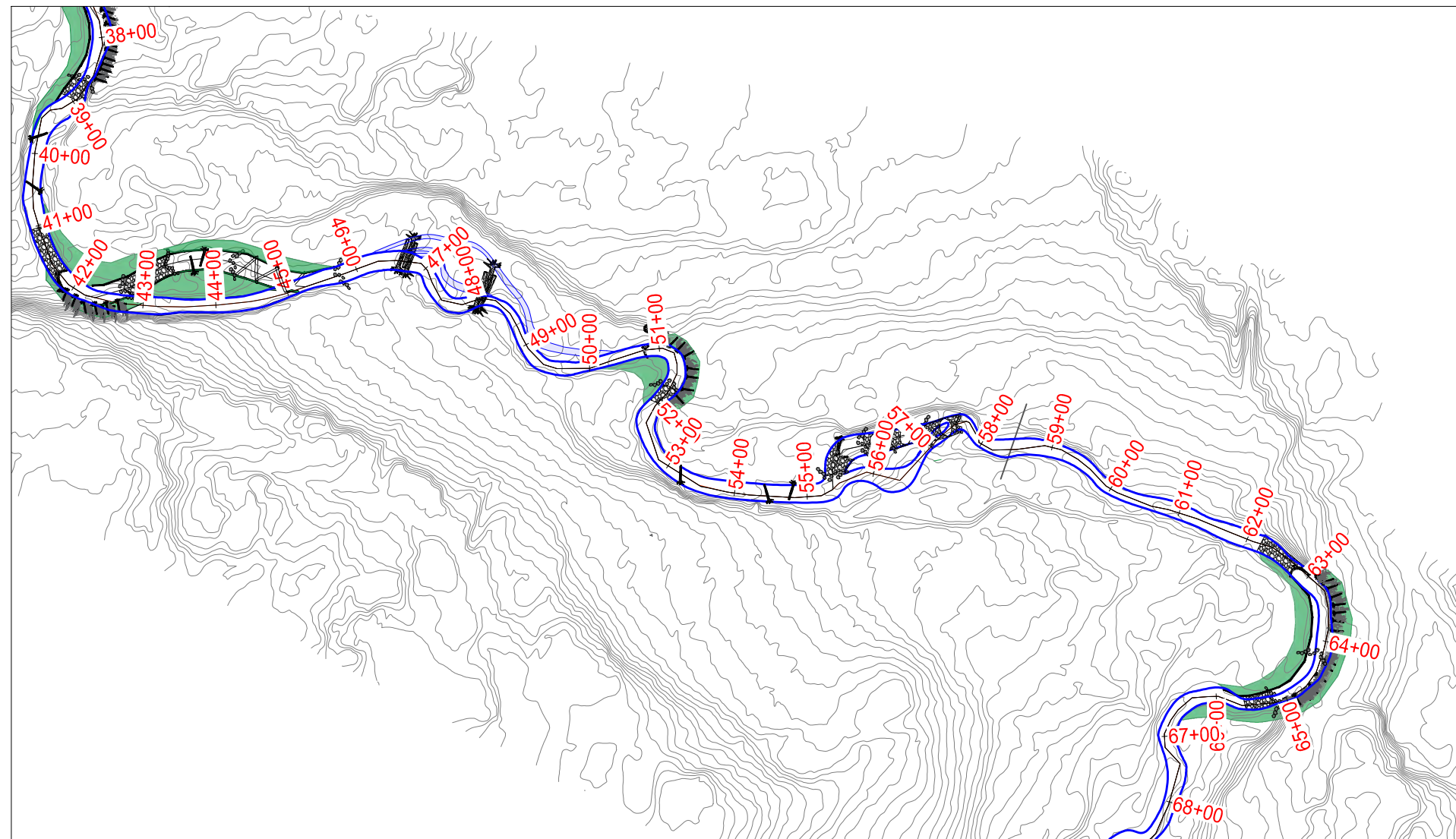
MN-DOT Seed Mix 32-241 Native Construction				
Common Name	Scientific Name	Rate (lb/acre)	Percent of Mix	Seeds/Sq ft
big bluestem	<i>Andropogon gerardii</i>	1.25	3.30%	4.60
side-oats grama	<i>Bouteloua curtipendula</i>	1.00	2.64%	2.21
fringed brome	<i>Bromus ciliatus</i>	1.40	3.69%	5.67
nodding wild rye	<i>Elymus canadensis</i>	2.00	5.26%	3.82
slender wheatgrass	<i>Elymus trachycaulus</i>	2.50	6.57%	6.33
Virginia wild rye	<i>Elymus virginicus</i>	2.00	5.26%	3.09
switchgrass	<i>Panicum virgatum</i>	0.75	1.97%	3.85
fowl bluegrass	<i>Poa palustris</i>	0.60	1.57%	28.50
Indian grass	<i>Sorghastrum nutans</i>	1.00	2.63%	4.40
Total Grasses		12.50	32.89%	62.47
Canada tick trefoil	<i>Desmodium canadense</i>	0.07	0.20%	0.15
partridge pea	<i>Chamaecrista fasciculata</i>	0.27	0.72%	0.27
wild bergamot	<i>Monarda fistulosa</i>	0.02	0.04%	0.39
black-eyed susan	<i>Rudbeckia hirta</i>	0.09	0.23%	3.00
hoary vervain	<i>Verbena stricta</i>	0.05	0.13%	0.50
Total Forbs		0.50	1.32%	4.31
Oats or winter wheat		25	65.79%	11.14
Total Cover Crops		25	65.79%	11.14
Totals		38	100.00%	77.91

GRAPHIC SCALE VERIFICATION
This bar measures 1" on 22"x34"
or 1/2" on 11"x17" original.
Adjust scale accordingly.



#	DATE	DESCRIPTION

DATE | JANUARY 2020
DRAWN | MGS/COD
DESIGNED | ACS
CHECKED | I
PROJECT # | J188372100
SHEET TITLE | PLANTING PLAN
SHEET NUMBER |

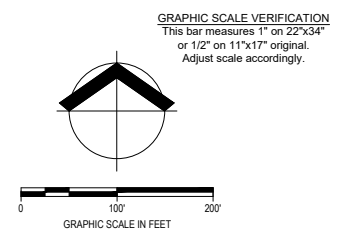


SEED MIXES

MN-DOT Seed Mix 34-361 Riparian Northeast				
Common Name	Scientific Name	Rate (lb/acre)	Percent of Mix	Seeds/Sq ft
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Riverbank wild rye	<i>Elymus riparius</i>	0.5	1.57%	0.53
Virginia wild rye	<i>Elymus virginicus</i>	2	6.33%	3.08
Tall manna grass	<i>Glyceria grandis</i>	0.25	0.80%	6.5
Fowl manna grass	<i>Glyceria striata</i>	0.09	0.29%	3
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Fox sedge	<i>Carex vulpinoidea</i>	0.2	0.65%	7.5
Path rush	<i>Juncus tenuis</i>	0.03	0.09%	10
Dark green bulrush	<i>Scirpus atrovirens</i>	0.12	0.38%	20
Woolgrass	<i>Scirpus cypeninus</i>	0.05	0.15%	30
Total Sedges and Rushes		0.5	1.61%	70.3
Marsh milkweed	<i>Asclepias incarnata</i>	0.12	0.38%	0.21
Flat-topped aster	<i>Doellingeria umbellata</i>	0.04	0.13%	1
Common boneset	<i>Eupatorium perfoliatum</i>	0.05	0.16%	3
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Giant sunflower	<i>Helianthus giganteus</i>	0.07	0.22%	0.25
Spotted touch-me-not	<i>Impatiens capensis</i>	0.03	0.11%	0.05
Blue monkey flower	<i>Mimulus ringens</i>	0.02	0.05%	13
Giant goldenrod	<i>Solidago gigantea</i>	0.02	0.05%	1.5
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Oats or winter wheat		25	79.37%	11.14
Total Cover Crop		25	79.37%	11.14
Totals		31.5	100.00%	202.67

TREE LIST

Inside Point Bar	Spacing	Plant Material
Adjacent to Stream		
Sand bar willow	4 ft o.c.	Live Stakes
Areas periodically flooded		
Tamarack	8-20 ft o.c.	Container
White spruce	8-20 ft o.c.	Container
Silver maple	8-20 ft o.c.	Container
Red maple	8-20 ft o.c.	Container
Bur oak	8-20 ft o.c.	Container
Black willow	8-20 ft o.c.	Container
Red osier dogwood	4 ft o.c.	Container
Areas of higher elevation		
Yellow birch	8-20 ft o.c.	Container
Mountain ash	8-20 ft o.c.	Container
Bur oak	8-20 ft o.c.	Container
White pine	8-20 ft o.c.	Container
Red pine	8-20 ft o.c.	Container
High bush cranberry	8-16 ft o.c.	Container
Outside Bends		
Non-Toewood Banks		
Speckled alder	8-16 ft o.c.	Container
Sandbar willow	4 ft o.c.	Live Stakes
Black willow	4 ft o.c.	Container
Tamarack	8-20 ft o.c.	Container
White spruce	8-20 ft o.c.	Container
Silver maple	8-20 ft o.c.	Container
Red Maple	8-20 ft o.c.	Container
Toewood Bench		
White pine	8-20 ft o.c.	Container
Red pine	8-20 ft o.c.	Container
Basswood	8-20 ft o.c.	Container
Paper birch	8-20 ft o.c.	Container
Yellow birch	8-20 ft o.c.	Container
Red-osier dogwood	8-16 ft o.c.	Container
High bush cranberry	8-16 ft o.c.	Container
Juneberry	8-16 ft o.c.	Container
Chokeberry	8-16 ft o.c.	Container
Smooth sumac	8-16 ft o.c.	Container



PLANTING PLAN

KNIFE RIVER

ENVIRONMENTAL TROUBLE SHOOTERS
LAKE COUNTY, MINNESOTA

#	DATE	DESCRIPTION

MN-DOT Seed Mix 32-241 Native Construction				
Common Name	Scientific Name	Rate (lb/acre)	Percent of Mix	Seeds/Sq ft
big bluestem	<i>Andropogon gerardii</i>	1.25	3.30%	4.60
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fringed brome	<i>Bromus ciliatus</i>	1.40	3.69%	5.67
nodding wild rye	<i>Elymus canadensis</i>	2.00	5.26%	3.82
slender wheatgrass	<i>Elymus trachycaulus</i>	2.50	6.57%	6.33
Virginia wild rye	<i>Elymus virginicus</i>	2.00	5.26%	3.09
switchgrass	<i>Panicum virgatum</i>	0.75	1.97%	3.85
fowl bluegrass	<i>Poa palustris</i>	0.60	1.57%	28.50
Indian grass	<i>Sorghastrum nutans</i>	1.00	2.63%	4.40
Total Grasses		12.50	32.89%	62.47
Canada tick trefoil	<i>Desmodium canadense</i>	0.07	0.20%	0.15
partridge pea	<i>Chamaecrista fasciculata</i>	0.27	0.72%	0.27
wild bergamot	<i>Monarda fistulosa</i>	0.02	0.04%	0.39
black-eyed susan	<i>Rudbeckia hirta</i>	0.09	0.23%	3.00
hoary vervain	<i>Verbena stricta</i>	0.05	0.13%	0.50
Total Forbs		0.50	1.32%	4.31
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Total Cover Crops		25	65.79%	11.14
Totals		38	100.00%	77.91

60% DESIGN

DATE | JANUARY 2020
DRAWN | MGS/COD
DESIGNED | JACS
CHECKED | J
PROJECT # | J188372100
SHEET TITLE
PLANTING PLAN
SHEET NUMBER
54
LAND USE #

MADISON
640 COTTONWOOD DRIVE, SUITE A
FITCHBURG, WISCONSIN 53719
TEL: (608) 861-2805 FAX: (608) 861-2861
www.cardno.com

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